Federal Plan for Ocean Pollution Research, Development, and Monitoring, 1979-83

First Draft
April 1979

Interagency Committee on Ocean Pollution
Research, Development and Monitoring

Federal Coordinating Council for Science,
Engineering, and Technology

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NOTICE TO REVIEWERS

ALL BUDGET FIGURES IN THIS DOCUMENT ARE PRELIMINARY AND SUBJECT TO CHANGE. THESE FIGURES AND ANY PRELIMINARY FINDINGS, ANALYSES, OR CONCLUSIONS BASED ON SUCH FIGURES SHOULD NOT BE CITED OR QUOTED. THIS FIRST DRAFT OF THE FEDERAL PLAN IS BEING CIRCULATED FOR REVIEW TO SOLICIT COMMENTS AND SUGGESTIONS ON THE CURRENT FEDERAL APPROACH TO OCEAN POLLUTION RESEARCH, DEVELOPMENT AND MONITORING AND ON FUTURE DIRECTIONS.

- Please submit comments in writing
- Please provide comments on all aspects of this document including analyses, conclusions and priorities
- Please make specific comments on the recommendations you feel the Committee should make in the final Plan
- Your recommendations will be considered in preparation of the final Plan
- This first Plan will be finalized by the Committee in early June, 1979

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FEDERAL PLAN FOR OCEAN POLLUTION

RESEARCH AND DEVELOPMENT AND MONITORING

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WORKING DOCUMENTS

1. Estes Park Scientific Workshop Proceedings

2. Tysons Corner National Needs and Problems Workshop Proceedings

3. Reports of the Research & Development, Monitoring, Needs & Problems, and Data Subcommittees of the Interagency Committee

4. Inventory of Federal Ocean Pollution Research and Development and Monitoring Programs

5. Inventory of Federal Facilities

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I. OVERVIEW OF THE FIRST FEDERAL PLAN

In May 1978 President Carter signed the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978 (P.L. 95-273) into law. The Act posed a major challenge to the Executive Branch -- "to establish a comprehensive 5-year plan for Federal ocean pollution research and development and monitoring programs in order to provide planning for coordination of and dissemination of information with respect to such programs within the Federal Government."

This document, and its associated Working Papers, are a major step in responding to that challenge.

By identifying the existing Federal effort in ocean pollution research and development and monitoring, recommending directions for future Federal efforts, and establishing goals which should be met during the next five years, this document constitutes a broad plan which can be used as the basis from which more specific plans can be developed. These specific plans, which will be issued as the biannual supplements, will give detailed, year-by-year goals and objectives for each Federal entity involved in ocean pollution related activities.

Congressional action calling for this plan and the Executive Branch work in developing the plan have taken place in an atmosphere charged with developmental, environmental, and economic pressures.

The plan, like the research and development and monitoring efforts which it discusses, does not attempt to resolve the conflicts among these pressures. Rather, it provides information and guidance which may be used by decision-makers as they attempt to resolve these conflicts by management techniques, regulatory procedures or legislation.

This document is a snapshot of the Federal effort to address ocean pollution problems in fisal year 1978. It is the first attempt to summarize the existing Federal effort and measure that effort against national needs which have been identified by decision-makers, regulators, scientists, and a cross section of public interest groups.

However, the document--and the planning effort directed toward establishing a coordinated Federal Ocean Pollution Program--is limited by several problems which will be solved over time. The major limitations involve the inventory of the Federal efforts and the budget process.

The Inventory of Federal Ocean Pollution Research and Development and Monitoring Programs, which was mandated by P.L. 95-273 and is a major source of information for the analysis reflected in this document, is extensive and surely captures the bulk of the Federal effort. However, it is not complete. Incomplete reporting of efforts resulted from difficulties in determining precisely which are "pollution-related." (For example, fishery stock assessments may be used in determining potential impacts of pollution, but are not routinely considered "pollution-related"

studies unless conducted in direct response to an oil spill or other polluting incident.) Difficulties also were encountered in determining which of the estuarine, coastal, and Great Lakes efforts should be included and in controlling the level at which efforts were reported. (For example, some reported efforts are actually individual tasks; others are projects which represent a number of tasks; still others are diversified programs.)

In addition, no attempt was made during this first plan to inventory ocean pollution-related efforts which are funded by the U.S. Congress, by State and Local Governments, and by private institutions, industry or interest groups which do or could provide information to the Federal Government.

The budget process followed by the Federal Government posed problems in projecting the inventory into future years. It was not possible in all cases, in the timeframe available, to determine specific efforts which may be continued or initiated and dollars which may be expended in the future. This problem has also been encountered by the National Climate Program whose experience and methods can provide some guidance, although their task is significantly different from the Federal Ocean Pollution Research and Development and Monitoring Program.

In spite of these limitations, the plan has already contributed to the Federal ocean pollution-related effort by beginning a dialogue between

the agencies and Federal employees involved in funding, managing, conducting, and using these projects and programs. The value of interagency familiarity with the scope of the Federal effort and of interaction among the various mission agencies cannot be easily quantified. However, it will have a beneficial effect on the work of the agencies. (A detailed description of the procedures which have been followed in implementing P.L. 95-273 is contained in Appendix A.)

The remainder of this chapter lists the General Findings which became obvious in studying the material gathered for the plan, the Recommendations of the Interagency Committee which has worked to implement P.L. 95-273, and Goals which the Committee has set for the first five-year period.

These General Findings, Recommendations, and Goals are based on public comment and materials found in the Working Papers and summarized in Chapters II and III. Chapter II contains a crosscut of the existing Federal effort by pollutant, regional effort, uses which are sources of pollutants, and impact on human health, living resources, and recreation. Chapter III contains a discussion of national needs which have been identified and priority ranked by scientists, interest groups, and Government agencies.

General Findings

- The Federal ocean pollution-related effort identified to date for purposes of implementation of P.L. 95-273 consists of more

than one thousand projects at a cost of $155 million in 1978 with a projected cost of $160 million in 1980.

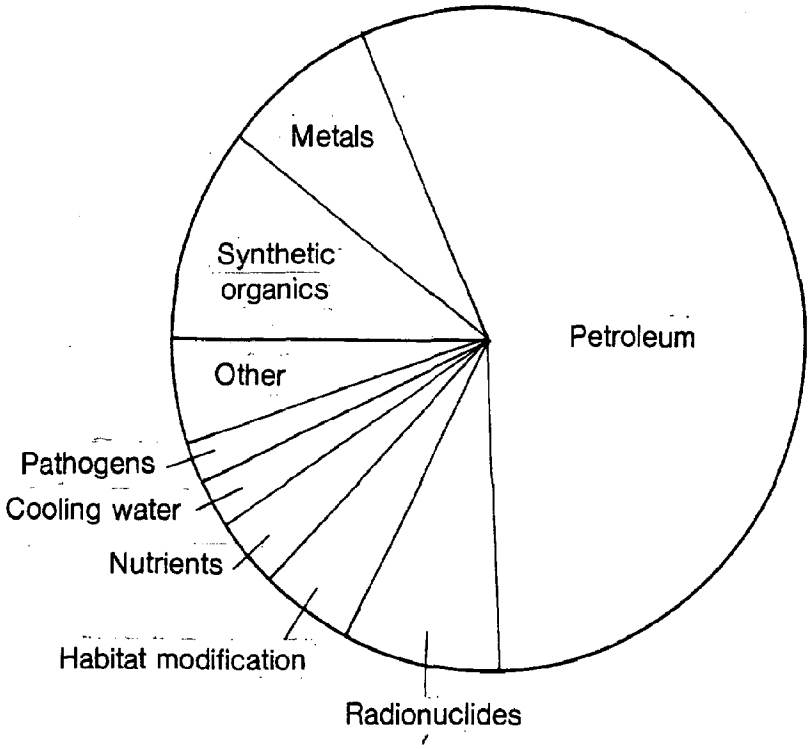
- More than one-half of the Federal effort is directed toward problems related to petroleum or petroleum development on the Outer Continental Shelf. (Figure 1)

- More than three-quarters of the Federal effort is directed toward specific sources of pollutants. The largest of these sources is extraction of minerals (including oil and gas), followed by waste disposal, transportation, and energy generation. (Figure 2)

- More than half of the Federal effort is directed toward projects in Alaska and the Mid-Atlantic. (Figure 3)

- The Department of the Interior provides funding for the largest portion of the Federal ocean pollution-related activities. The next largest funding agency is the Environmental Protection Agency, followed by the Department of Commerce, the National Science Foundation, and the Department of Energy respectively. (Figure 4)

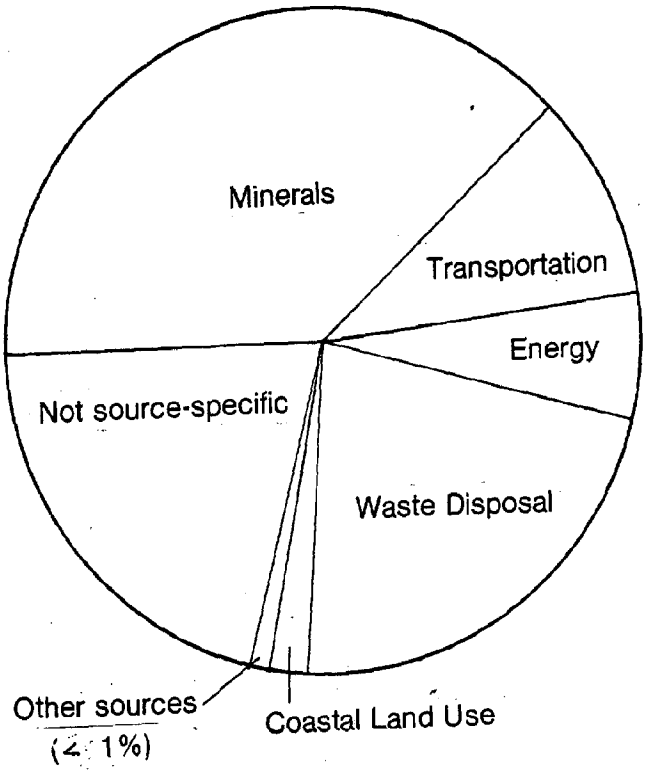
- Roughly five-sixths of the Federal effort is spent in research projects, while the rest is directed toward monitoring and technology development. (Figure 5)



FY 1978:

Pollutant-specific (as shown)	Approx. $ 107 million
Pollutant-nonspecific	Approx. $ 48 million

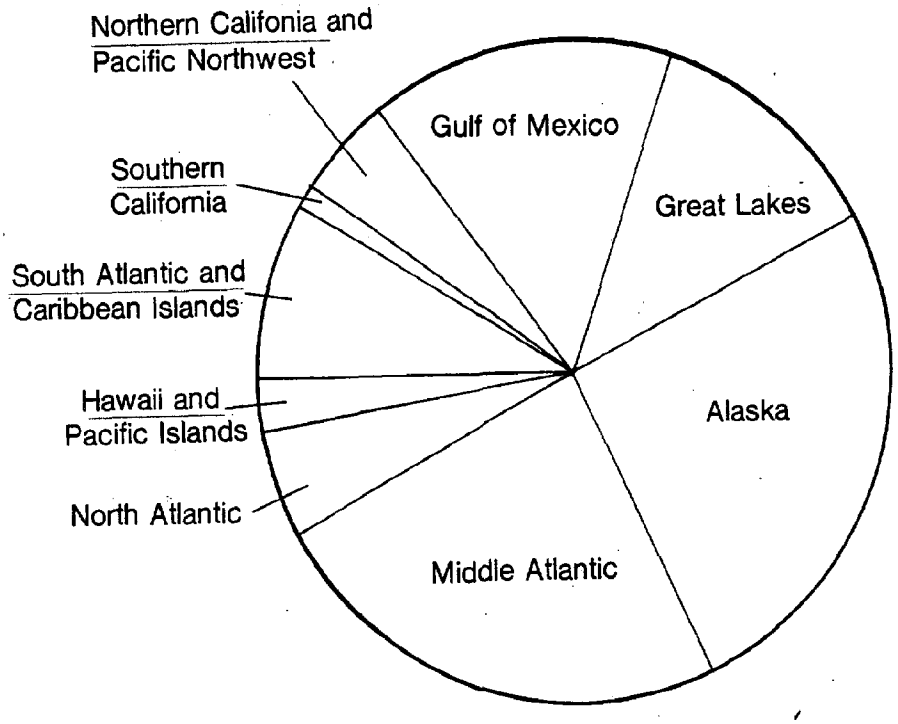
Figure 1.-- Current Federal Program for Ocean Pollution Research, Development, and Monitoring analysis by pollutants.



FY 1978:

Approx. $ 155 million

Figure 2.-- Current Federal Program for Ocean Pollution Research, Development, and Monitoring analysis by sources of pollution.



FY 1978:

Region-specific (as shown)	Approx. $ 95 million
Region-nonspecific	Approx. $ 60 million

Figure 3.-- Current Federal Program for Ocean Pollution Research, Development, and Monitoring analysis by regions.

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FIGURE 4

Ocean Pollution

Research, Development, and Monitoring Programs

for 1978 -- 1980

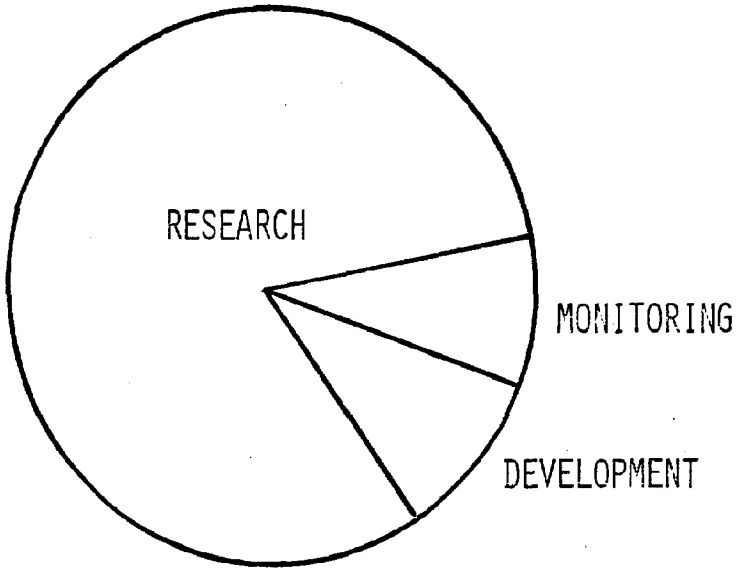
Department of the Interior	$44,932K	$41,884K	$58,431K
Environmental Protection Agency	36,481K	28,364K	28,364K
Department of Commerce	17,538K	22,765K	24,040K
Department of Energy	15,514K	16,804K	15,168K
National Science Foundation	15,534K	15,006K	13,655K
Department of Defense	8,577K	7,066K	6,445K
Department of Transportation	8,809K	8,448K	5,991K
Department of Health, Education, & Welfare	4,113K	3,718K	3,583K
National Aeronautics & Space Administration	1,750K	531K	1,050K
Nuclear Regulatory Commission	1,245K	955K	885K
Department of Agriculture	152K	154K	140K
	$154,645K	$145,695K	$157,752K

FIGURE 5

CURRENT FEDERAL PROGRAM

EFFORT BY RESEARCH, DEVELOPMENT, AND MONITORING

FY 1978



- Most of the Federal ocean pollution-related effort responds to specific operational mandates for regulatory control, licensing, resource management, and preservation of health and safety.

- A smaller portion of the Federal ocean pollution-related effort focuses on baseline studies and assessment of conditions for the purposes of environmental impact statements and agency policy formulation.

- The smallest portion of the Federal ocean pollution-related effort, primarily that funded by the National Science Foundation, is basic research which is not mission oriented but which ultimately contributes to the knowledge necessary to pursue agency missions.

- Highest priority areas for the Federal ocean pollution research and development and monitoring effort are industrial waste disposal, land use practices, municipal sewage outfalls, oil and gas development, oil transportation, steam electric power plants, and transportation of hazardous materials.

- Medium priority areas for the Federal ocean pollution research and development and monitoring effort are deep seabed mining, fish and shellfish processing, hatcheries and aquaculture,

ocean dumping of dredged material, recreation, sand and gravel and shell mining, and sewage sludge dumping.

- Low priority areas for the Federal ocean pollution research and development and monitoring effort are biomass fueled energy systems, brine producing activities, ocean kinetic energy systems, ocean thermal energy conversion, salinity gradient energy systems, and satellite power energy systems.

- Major benefits to the Federal program can result from encouraging and facilitating linkages and interchanges between existing ocean pollution-related projects.

- Ocean pollution-related projects could provide additional information for use in the decision-making process if more emphasis is placed on integration, analysis, and dissemination of project results.

- The Federal ocean pollution-related effort is largely crisis-oriented. However, a multi-agency plan which identifies on-going work and general goals could result in a Federal program which is focused on national needs while remaining flexible enough to respond to crises situations without being distorted by them.

- It appears that the critical national needs which are currently identified in relation to ocean pollution can be met within the existing financial framework. Huge new sums of money apparently are not immediately necessary.

- Pollution-related needs appear to be most efficiently and effectively addressed at the regional, rather than national or local, level.

- It will take time to develop a review of ocean pollution-related budget items across agency lines; however, such a review could identify ways to make the best use of funding.

Recommendations of the Committee

Recommendations will be developed by the Interagency committee on Ocean Pollution Research and Development and Monitoring based on the analysis in this document and comments by reviewers. The Interagency Committee recommendations will be printed at this point in the document when a final version is prepared.

Goals for 1978 - 1983

Based on the analysis in this document and its associated Working Papers, the general findings, and recommendations of committee members and reviewers, the Interagency Committee will develop an initial set of goals for the first five-year National Ocean Pollution Program.

These goals, and milestones for accomplishing them, will focus on substative research and development and monitoring issues and on ways to improve the interagency planning process. The goals will be printed at this point in the document when a final version is prepared. Goals and milestones for the first plan period are shown in Figure 6-9, which will be expanded in the final version.

FIGURE 6

SCIENTIFIC AND TECHNICAL GOALS AND MILESTONES

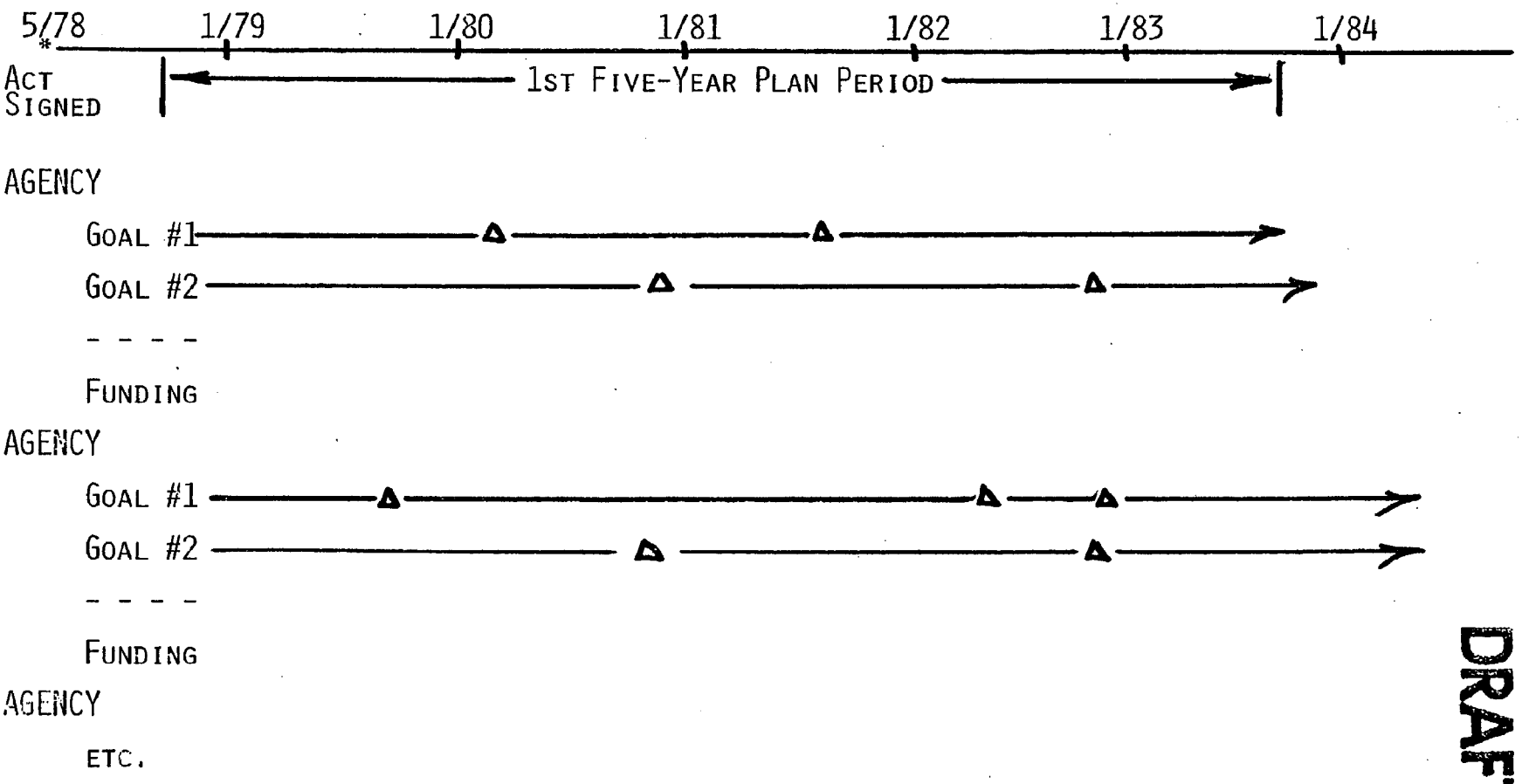


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FIGURE 7

FEDERAL PROGRAM INVENTORY

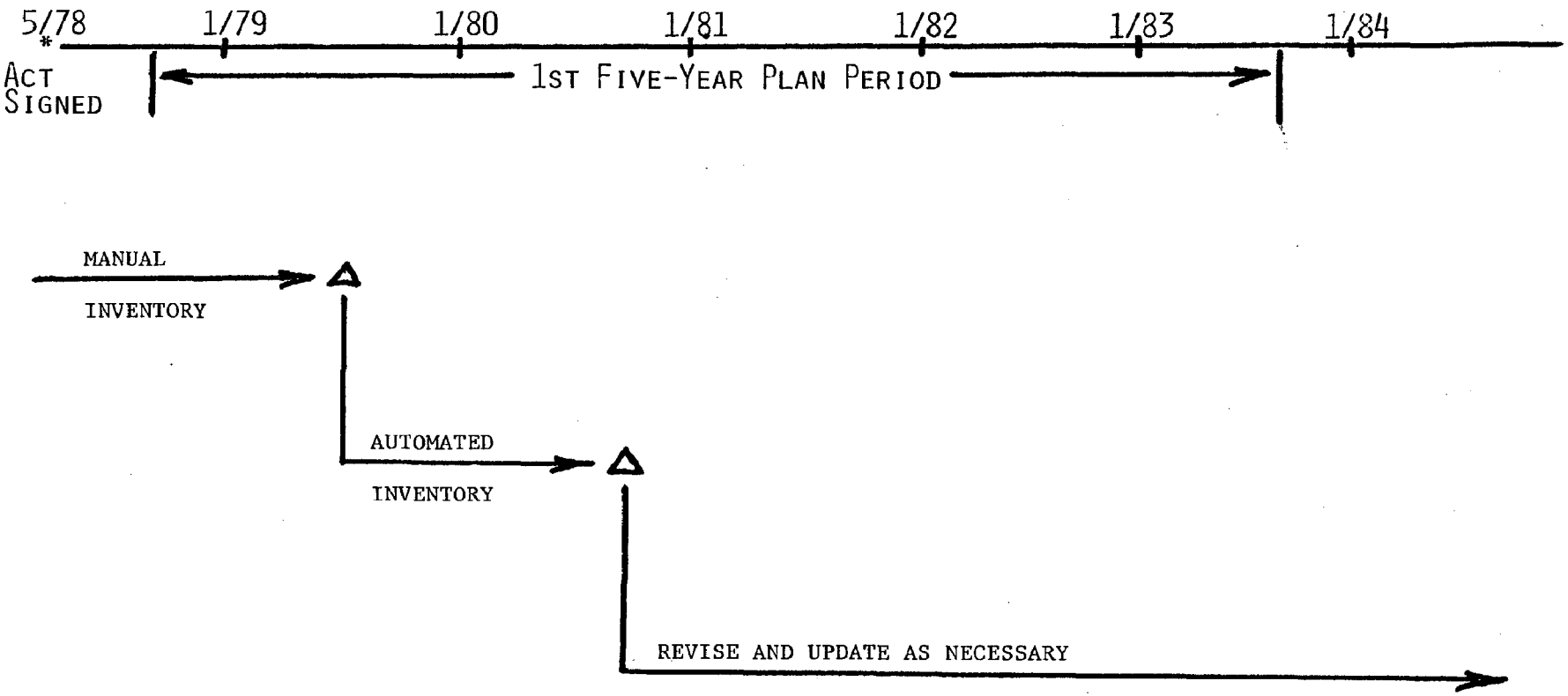

FIGURE 8

FEDERAL OCEAN POLLUTION RESEARCH AND DEVELOPMENT AND MONITORING BUDGET STATEMENT

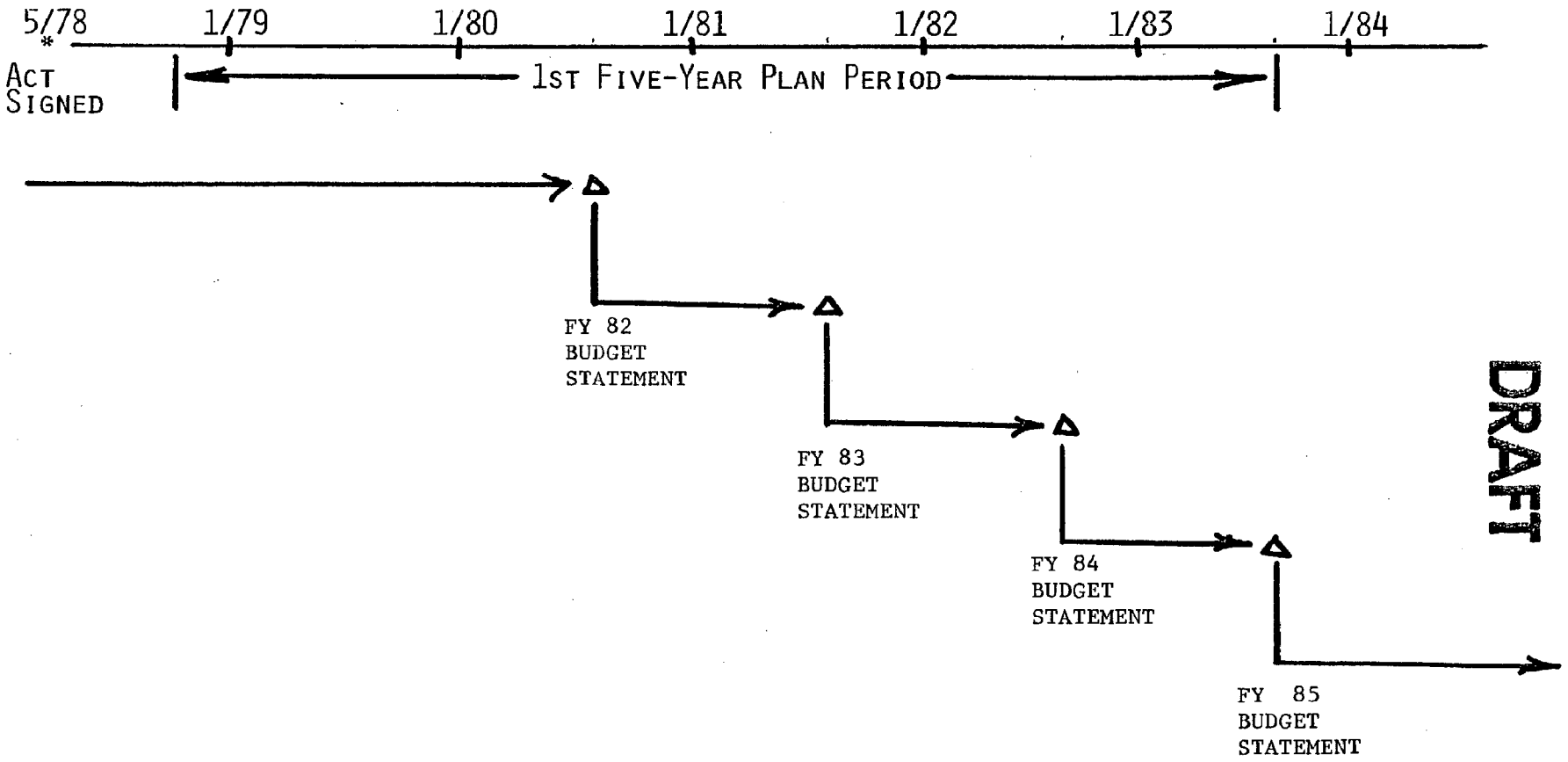

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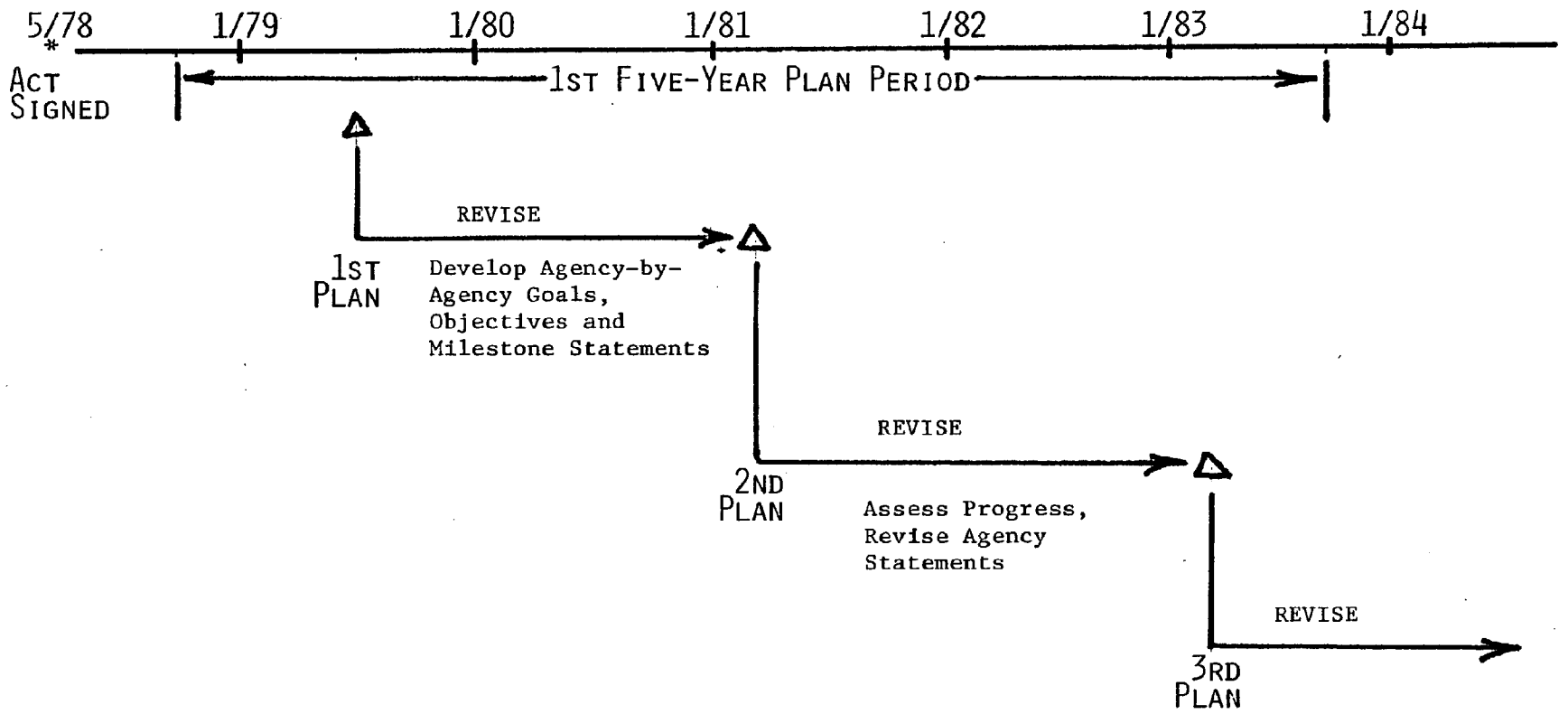
FIGURE 9

FEDERAL PLAN REVISION SCHEDULE



II. ANALYSIS OF CURRENT FEDERAL EFFORT

The current Federal program for ocean pollution research, development, and monitoring is funded at approximately $155,000,000 in fiscal year 1978 and will continue at about that level through 1980. A major part of the effort in this first plan has been to identify the Federal projects and programs that address ocean pollution problems.

In identifying ocean pollution problems, it is apparent that the various national constituencies have different perspectives on how to look at national needs and problems. The scientists tend to look at the problems from either a pollutant or environmental systems point of view. The public is worried about the region they live in. Industries are concerned about pollution regulations on activities in ocean and coastal areas. And both the legislative and executive branches of the Federal government must deal with laws, regulations, and policies that affect sources of pollution.

This analyses tries to deal with these three perspectives -- pollutant, regions, and sources. In addition, there is an important impact section that identifies the need for common approach to problems of human health, living resources, and recreational resources. These needs cut across the Federal program and should be considered for any effective Federal Program.

A. Pollutants of Concern in the Marine Environment

Federal research and monitoring programs can be described in two broad categories. These are 1) generic studies which collect baseline data, define natural processes, and identify types of information which apply to all pollutants, and 2) specific studies which are directed at individual classes of pollutants or pollutant problems. The specific studies focus on the following major categories of pollutants:

- o petroleum and petroleum products
- o synthetic organic chemicals
- o metals and inorganic chemicals
- o artificial radionuclides
- o habitat modification and sedimentation
- o nutrients and other biostimulants
- o cooling water
- o microorganisms and pathogens
- o chlorination products
- o other pollutants.

All of the Federal agencies involved in the review mandated by P.L. 95-273 have supported generic studies, which accounted for 39 percent of the total Federal program. Specific studies accounted for 61 percent.

More than half of the Federal funding (54%) was spent on research, development, and monitoring related to or made necessary by petroleum and petroleum products. Approximately 14 percent was spent on studies related to or made necessary by synthetic organic chemicals, and 13 percent was spent on studies related to or made necessary by metals and inorganic chemicals. The remaining funding (19%) was spread among seven categories of pollutants and pollutant problems.

The need for Federal research and development and monitoring is not generally identified by pollutant, but rather by an ocean or coastal use which is the source of pollution or by geographic regions which are or may be impacted by pollution. For that reason, the following analysis discusses only how the existing Federal program addresses these pollutants, not what further work may be necessary. The adequacy of these programs is discussed in the sections of this report which analyze the Federal program by regions and by sources of pollution.

An attempt to identify national needs and make recommendations related to specific pollutants was made by scientists at the Estes Park workshop of July 1978. Their work is contained in Working Paper No. 1.

1. PETROLEUM AND PETROLEUM PRODUCTS

Contamination of the marine environment by petroleum has received extensive publicity in recent years. In many instances the dominant theme has been the threat of ecological disaster resulting from petroleum spills. In certain cases (for example, the recent Amoco Cadiz spill in France) some of the worst fears for damage to some marine species and associated industries appear to have been realized. In other instances, little damage has been detected after fairly substantial introductions of petroleum into the marine environment -- at least in the short term. The latter spills have not reached coastlines. They were in open ocean areas where natural conditions contributed to rapid dilution, evaporation, and dispersal.

Nevertheless, the continued introduction of large amounts of petroleum and petroleum products into the oceans remains a potential problem to the viability of marine environments. Generally, concentrations of water-soluble fractions of crude petroleum on the order of parts per million are needed to kill most marine animals in laboratory studies. However, short-term exposure to concentrations of petroleum hydrocarbons in the much lower parts-per-billion range disrupt behavior patterns of certain marine animals. Very little is known about long-term effects of petroleum exposure on the marine environment.

Crude petroleum and petroleum products are composed of hundreds of different individual components. Some of these components are readily measured; others can be quantified only by the most advanced analytical chemical techniques; and others cannot at present be measured. Petroleum hydrocarbons are metabolized by the enzymes of fish and other marine species, so that after exposure to petroleum their tissues contain some of the original petroleum components and a variety of metabolites of the original petroleum components. Only a few of the metabolites have been identified so far, and their effects on marine animals are largely unknown. Moreover, spilled petroleum is continually changing chemically ("weathering") in the ocean, and the effects on the marine biota of these changes are in general not known.

One third of the total Federal research, development, and monitoring program is directly related to studies of petroleum and petroleum products. More than $47 million was spent in FY 1978 primarily by the USOI (64%), EPA (15%), and the USCG (9%), with NOAA, Navy, HEW, and DOA having programs amounting for the other 12 percent. Almost half of the program ($22.7 million) was devoted to baseline studies funded primarily by BLM with a few small projects by EPA and DOE. Slightly more than 25 percent were biological studies, 57 percent physical and chemical studies; the remainder were directed toward the study of geological hazards.

15 percent of the total program was used to study the effects of oil on birds and mammals, fish and benthic organisms, plants and ecosystems in general. 10 percent was used to study the behavior and movement of

oil including measurement of existing distributions and development of dispersion and trajectory models.

The USCG, NOAA, EPA, and BLM spent more than $2 million on studies of spills of opportunity such as the Amoco Cadiz.

Approximately $5 million (11% of the total program) was spent on development activities related to oil and hazardous materials pollution. A small amount ($750,000) was used by USGS for development of equipment related to safety and inspection of offshore platforms. More than $3 million was used by the Coast Guard, Navy, and EPA to develop and test clean-up and containment systems for spilled materials and treatment systems for oily waste water discharged from vessels; $1 million was used to develop sensors and systems for detection and surveillance of oil and hazardous materials. Less than 1 percent was directed by Coast Guard and EPA to techniques for reducing or preventing spills from damaged vessels.

More than 3 percent of the total program was spent by EPA, the Coast Guard, and NOAA for the development of chemical and biological methods for measuring hydrocarbons and their effects; although BLM plans to increase its effort by FY 1980, in FY 1978 $140,000, less than 0.5 percent, was aimed at quality assurance.

Research related to economic impact and cultural and aesthetic aspects of OCS activities accounted for less than 1 percent of the overall program in 1978; however, these studies are expected to be substantially expanded in FY 1979 and 1980.

Of the $47 million accounted for in the category of petroleum and petroleum products, approximately 14 percent was related to spill response and clean-up activities -- activities which are also aplplicable to other hazardous materials. It is estimated that the remainder of the program was solely oil related.

2. SYNTHETIC ORGANIC CHEMICALS

In this category are a large number of organic chemicals, pesticides, and herbicides, many of which have been developed in only the past few decades. Hundreds of different compounds are included; one broad class are the aromatic halogenated hydrocarbons (e.g., DDT, PCBs, dieldrin). These halogenated hydrocarbons have gained wide acceptance as solvents, pesticides, heat exchangers, dialectrics, and polymer intermediates; some are characterized by a high degree of chemical stability. Characteristically, these compounds are extremely insoluble in water; however, they can be transferred to living organisms. Another broad class is the lower molecular weight chlorinated hydrocarbons whose bioaccumulation factors are 100 to 1,000 times smaller than their heavier aromatic counterparts. Many undergo more rapid degradation in the environment. Although toxic levels of the lower molecular weight hydrocarbons are much higher than known levels in the marine environment, little is known about sublethal effects on marine organisms.

Another class of synthetic organic chemicals is the organophosphate compounds (e.g. Malathion, Parathion, Chlorfeninphos) which is to some extent replacing the aromatic organochlorine insecticides. These are

less persistent in the environment than aromatic organochlorines. They act on the nervous system and may be toxic to mammals and aquatic species. Because of their degradability, however, they probably cause problems in local areas. The same is most likely true of the carbamate compounds, another class of insecticides sometimes used in place of DDT.

There are in addition several herbicides, including a variety of organic mercurial compounds used in agriculture, and metal-containing pesticides, that pose varying degrees of potential threats to living resources.

The scientific literature contains reports of lethal and sublethal effects from synthetic organic chemicals on marine and freshwater species. The threshold concentrations necessary to cause such effects in marine animals vary widely between different species and with different chemicals. Sublethal, or chronic, effects of synthetic organic chemicals can be either reversible or irreversible, depending on the circumstances of exposure, including factors such as the life stage of exposed animals, concentration of the pollutant, and duration of exposure. The most severe and irreversible effects of synthetic organic chemicals have been observed with early life stages (embryos through juvenile) of marine fish and invertebrates. Lethal effects of these compounds frequently result from disruption of the nervous system. DDT (and especially its breakdown product DDE) has been particularly implicated in effects on birds, including sea-birds, ranging from various subtle disturbances in behavior to egg-shell thinning resulting in reproductive failure. Such effects have been implicated in near-total collapses of some bird populations.

Restrictions have been imposed on the release of both DDT and PCBs in the marine environment; nevertheless, even if future use is eliminated, parent compounds and/or derivatives will persist for many years because of their chemical stability.

Over $12 million was spent in FY 1978 on research related to synthetic organic chemicals, pesticides, and hazardous and toxic organic substances, other than petroleum, in the marine environment. Over 60 percent of this was spent by EPA with NSF, DOT, and NOAA each having programs over $1 million.

About 23 percent of the effort was support of research on the effects of synthetic organic chemicals. Approximately 75 percent of this research was directed toward ecosystem effects and changes in growth and reproduction rates for organisms exposed to these compounds. EPA and NSF supported most of the "effects" studies. The other 25 percent of these "effect" studies is related to human health and the identification of mutagenic, carcinogenic, and teratogenic organics in the marine environment. In addition, research is being carried out to determine the pathways of organics in the human food chain and direct effects on human health.

The DOT and EPA spent approximately 16 percent of the total on research to develop methods for cleaning up and detecting hazardous chemical spills, and for developing techniques to prevent future spill occurrence.

Seven different agencies supported research for determining the ecosystem information necessary for evaluating the sources of organics and pesticides. These studies include identifying new organics in the

marine environment, monitoring present levels, and determining distribution patterns. Approximately 3 percent of the total funds were spent in this area of research and monitoring.

EPA and NOAA have research and monitoring programs for organics in the Great Lakes accounting for approximately 6 percent of the total funds. These studies cover the spectrum of information needed to understand organics in the Great Lakes ecosystem. Additionally, a significant effort is being made to understand the movement and effects of PCBs in the marine and Great Lakes ecosystems. Six percent of the total synthetic organic chemical funds were spent by EPA and NOASA on PCB research with about 75 percent of this being conducted in the Great Lakes watershed.

EPA also has a major research and monitoring effort related to organics and pesticides in the Chesapeake Bay accounting for approximately 26 percent of the total spent on organics. These studies are designed to understand the distribution, fate, and effects of pesticides and toxic organics in the Chesapeake Bay ecosystem and to monitor input levels of these materials to the Bay.

NOAA supports a research and monitoring effort (4% of the total) to provide information needed to determine the effects and safety of ocean disposal sites for pharmaceutical wastes.

The remaining 3 percent of the total for synthetic organic chemicals was spent to develop methods for measuring these materials in the marine

environment. Of this 3 percent, approximately half was identified for quality assurance and interlaboratory comparison of data and methods.

3. METALS AND INORGANIC CHEMICALS

Inorganic chemicals which are considered to be particularly important marine pollutants include metals, acids, alkalis, and cyanides. Although the latter three types can be highly toxic in localized areas, their effects are quickly netutralized by the ability of seawater to buffer, biodegrade, and essentially inactivate them in the environment. Human-induced sources of metals and inorganic chemicals include the release of industrial and sewer effluents into rivers and oceans, the combustion of fossil fuels, and the disposal of wastes in the ocean. Because it is often difficult to distinguish between this input and natural geochemical fluxes, the impact of metallic wastes on the marine environment is difficult to assess.

The most toxic metals are considered to be mercury, silver, copper, cadmium, lead, zinc, chromium, tin, and selenium. Several factors may influence the toxicity of these metals on a particular marine organism. They are (1) the physiochemical form of the metal, (2) the synergistic or antagonistic action of other associated compounds, (3) the condition of the seawater (salinity, temperature, pH, etc.), and (4) the physiological condition of the organism. Much of the information about lethal effects of metals on marine animals has been demonstrated in short-term laboratory experiments. The basic mechanism for these acute effects is primarily interaction of metals with tissue proteins, often resulting in enzyme inhibition. Long-term, sublethal effects of some metals have also been

demonstrated by laboratory experiments; the main effects have been genetic deformity.

Although high concentrations of metals have been detected in marine organisms, these instances were generally quite localized and occurred near the point source inputs. In a few isolated cases such as the Minimata mercury disaster, metals have found their way to humans through the food chain. Few examples have been reported in the scientific literature of deleterious effects in free-living marine organisms from high levels of metals. However, as with most pollutants, increased contamination by metals in the marine environment may lead to harmful effects on the biota. Some detrimental effects on the marine ecosystem could occur when soluble concentrations of metals are about ten times the normal value.

Almost $11 million was spent in FY 1978 studying metals and inorganic chemical estuarine and ocean ecosystems and the Great Lakes. Most of this research effort (92%) was supported by DOE, EPE, NSF, and NOAA. Other agencies supporting research on metals and inorganic chemicals were NSF, USDI, HEW, DOD, and DOA.

Studies on characterization of metals, their distributions, movement, exchanges and fate in the physical ecosystem accounts for 34% of the effort. These studies were supported by NSF, DOE, NOAA, DOI , and EPA. These studies vary from baseline studies needed for understanding the behavior of metals and inorganic chemicals in physical systems to studies on the distribution of metals in sediment, sediment-water interface, water, and the air above the ecosystem. Studies involve over 20 different metals.

DOE is supporting a major effort on the effects and fate of brine disposal from proposed salt dome storage facilities for petroleum reserves. These studies while also concerned with brine and temperature effects account for 23 percent of the metal efforts in FY 1979; funds to support this effort are proposed to triple in FY 1979 and be reduced in the following years.

Another major effort (19% of the total funding) deals with metals in the food chain and their movement and concentration through different trophic levels of the ecosystem. These studies involve the effects of metals on the growth and reproduction of organisms and possible effects on human health from their consumption.

EPA supports a major effort (9% of the total metal funding) on the Chesapeake Bay. EPA (8% of the total funds) and NOAA (1% of the total funds) support studies on the Great Lakes. These studies on the Chesapeake Bay and the Great Lakes are to define the distribution movement, exchange, and baseline conditions in these ecosystems so that a better understanding can be developed of the effects of additions of metals.

Five percent of the total funds were spent to determine the fate and effects by metals and inorganic chemicals in waste disposal areas, primarily in the New York Bight, in conjunction with the MESA program. A small effort (less than 1% of the total effort) was spent directly on developing new methods and techniques for determining metals in the marine environment and for quality assurance.

4. ARTIFICIAL RADIONUCLIDES

The principal human-induced sources of radionuclides are fallout from nuclear weapon explosions and releases from nuclear power facilities. The physiochemical interactions by which radionuclides are distributed in the marine environment are not well understood, especially with respect to the transuranics (plutonium, americium, and curium). A large proportion of the transuranics ultimately reach ocean sediments by a process determined through environmental factors and biological actions. Although much is known about the concentrations of artificial radionuclides in the marine environment, it is difficult to assess impacts because so little is known about their chemical behavior.

Potential toxic effects of artificial radionuclides on marine organisms would be expected at both the population and individual organism levels. Assessment of effects on populations is hampered by the lack of relevant experimental data. Although natural and laboratory populations have been exposed to radiation, the dose rates were much in excess of those that exist or may be expected to exist in marine ecosystems. Experimentation with individual marine organisms has demonstrated that transuranic-derived alpha particle radiation causes biological changes with primitive animals being more resistant and young fishes being most sensitive. It has been postulated that low-level exposure to radiation can cause genetic changes.

Even though artificial radionuclides can be toxic to marine plants and animals, no deleterious effects on these biota would be expected

from current levels of radioactive elements in the marine environment. The radiation dose received by humans from worldwide fallout via food from the oceans and from discharges into the sea by power-producing reactors is at present very small. With increasing future uses of atomic energy, however, the risk of accidental contamination of the marine environment becomes greater. Such contamination could lead to an increase in background levels and to point sources of artificial radionuclides which might be damaging both to marine biota and to man.

In FY 1978 approximately $4.5 million was spent on ocean related research, development, and monitoring for radionuclides by DOE, NRC, EPA, NSF, and FDA. Approximately 50 percent of the program was supported by DOE, and 25 percent by NRC.

EPA contributed 11 percent (expected to expand to 22 percent by FY 1980 due to program transfers from DOE) for study of the fate and effects of materials disposed at oceanic radioactive waste dumpsites during the past two decades. FDA spent approximately 3 percent on the national shellfish moniitoring program.

Most DOE activities were directed toward defining natural ocean processes that influence radionuclide distribution (16%), and to understanding the behavior and fate of radionuclides derived from both fallout and nuclear waste disposal in the ocean and estuaries (18%). NSF sponsored an additional 10 percent for basic research directed at understanding the behavior and distribution of radionuclides in the ocean. Small regional projects (less than $200,000 per year) on detemining radionuclide levels in sediments and concentration rates through the food

chain, are being carried out in the Columbia River estuary off the coast of Washington and in the Gulf of Mexico. A slightly greater effort ($300,000) is taking place around Bikini and Eniwetox atolls in the Marshall Islands defining the physical characteristics, circulation, and groundwater geochemistry related to level and distribution of radionuclides.

The NRC directed almost all of its efforts toward developing models and studying transport of radionuclides associated with nuclear powerplants. A study on the behavior of radionuclides from nuclear powerplants is planned for FY 1980.

Relatively little money from the ocean pollution program has been or is planned to be used to determine the effects of radionuclides on organisms and humans. Of the total, 4 to 5 percent is being directed toward study of the effect and mechanisms of radionuclide uptake by organisms and on monitoring radionuclide levels in shellfish.

5. HABITAT MODIFICATION AND SEDIMENT DEPOSITION

Marine habitats may be modified by uncontrolled or polluted sediment deposition. Sediment degrades many marine ecosystems both as a carrier of adsorbed pollutants and in excessive quantities as a pollutant itself. Sediment enters the marine environment as a result of natural land runoff and through disposal operations for dredged materials. In excess, it can modify habitats by physically covering benthic ecosystems and reducing light penetration; as a carrier of other pollutants it can introduce

nutrients and toxic materials which have been adsorbed on the surface of sediment particulates; these in turn modify the habitat. Habitats may also be modified by other activities related to indiscriminate removal and disposition of sediment such as dredging and deep-sea mining.

The COE and NOAA account for 82 percent of the approximately $4 million spent on pollution research, development, and monitoring activities related to habitat modification and sediment deposition in FY 1978. Other agencies involved were EPA, FWS, USGS, and Navy.

NOAA spent 25 percent of the total in this category in the Deep Ocean Mining Environmental Studies (DOMES) Program to determine the possible environmental consequences from deep seabed mining. This program included studies on the effects of the mining dredge on benthic populations, as well as the effects of the sediment plume discharged on the ocean surface.

Approximately 55 percent of the total was spent on dredging and dredged material related studfies by the COE, NOAA, EPA, and USGS. Of this 55 percent, 17 percent was directed by the COE, EPA, and NOAA toward determining the effects of dredged material dumping on benthic organisms, on characterizing changes at disposal sites and on stabilization methods for disposal sites. 38 percent was spent primarily by the COE with limited participation by the Navy and USGS, on exploring dredging alternatives, techniques, and equipment for minimizing dredging and dredging effects and beach nourishment. The other 45 percent of the dredging total, almost $1 million, was spent by the COE on studies of breakwater and channel stability and development of methods to reduce siltation in channels, as well as models to predict sedimentation resulting from storms.

Construction and structure placement are additional sources of sedimentation and habitat modification. Approximately 8 percent of the total funds was directed toward studies and modeling for predicting the effects of structure placement on wetlands and on sedimentation in navigational channels, control of sedimentation during construction and design of small basins with maximum flushing characteristics. A small effort, $67,000, was spent by the EPA on the effects of pipeline burial in the Gulf of Mexico, but a considerably larger effort in the Gulf ($1 million) on this problem is planned by BLM for FY 1979.

The remainder of the work in this area consisted of small studies by EPA, NOAA, and FWS ($250,000) on wetlands and estuaries in Alaska and the impact of logging and other activities on these ecosystems, as well as $150,000 on the effect of recrational boating on aquatic vegetation, in the Chesapeake Bay, and the effect of water use practices on Great Lakes fish.

With the exception of the DOMES projects, which is expected to decrease, most efforts are planned to continue at similar levels through FY 1980.

6. NUTRIENTS AND OTHER BIOSTIMULANTS

Primary production in the world's oceans can vary by a factor of 100. In contrast to freshwater systems where phosphate is the limiting nutrient for production of plant life, nitrogen is probably the limiting nutrient

for plant growth in the sea. Highest primary production rates are normally associated with an abundant and balanced supply of nutrients, ideal sunlight conditions, and temperature. Unbalancing the nutrient supply can result in quite different effects. There have been few attempts to rigorously quantify in the environment effects of nutrient enrichment on the quantity and quality of plant and animal life. Attempts have been made, however, to correlate laboratory studies on balanced nutrient enrichment with field values and predict possible changes. The predictions, as expected, range from general enhancement of growth of original plants and animals, to grossly altered ecosystems in terms of species selection, to complete loss of ecosystem viability.

Nutrient enrichment may be either beneficial or extremely detrimental to many existing aquatic plants and animals and to marine ecosystems.

Ocean related research, development, and monitoring on nutrients amounting to almost $3.5 miillion was carried out by EPA, NOAA, DOE, and DOI in FY 19788; 23 percent of the effort ($900,000) was carried out in the Great Lakes; and 35 percent ($1.4 million) was carried out in the Chesapeake Bay by EPA and USGS. Of the $3.1 million spent in marine waters, approximately 13 percent was spent by DOE, on studying the sources of nutrient rich waters, and their impact on phytoplankton in the South Atlantic Bight. This effort is expected to expand modestly through FY 1980. EPA funded several projects on the effects of nutrients on marine organisms; however, in FY 1978 these amounted to less than 6 percent of the total spent and are planned to end by FY 1980. NOAA and

EPA both funded mariculture related research on the relationships between nutrients and commercially important fish and shellfish (8%) and on the use of marine organisms for waste disposal (12%) (sewage and rum distillery wastes). Approximately 8 percent of the marine related work is directed by NOAA and EPA toward development of management information -- primarily models which include nutrient effects in the Chesapeake Bay, Louisiana wetlands, the New York Bight, and Orange Lake in Florida. NOAA spent less than 1 percent in developing instrumental techniques for measurement of nutrients.

Slightly less than $900,000 was spent on nutrient related research in the Great Lakes by EPA, NOAA, and DOE. Approximately 90 percent of that was directed toward dollecting information leading to development of models describing the relationships between nutrients and phytoplankton, and algal blooms. The remaining 10 percent was directed toward models addressing the effects of land-use paractices.

Several studies include, to a limited extent, consideration of the effects of metals, synthetic organics and/or hydrocarbons on nutrients relationships.

7. COOLING WATER

The use of marine waters as cooling water in coastal power and industrial plants causes problems resulting in pollution of several forms. Cooling water is usually returned at temperatures higher than the receiving

water-body temperature. This can cause temperature stresses on local biological communities; synergistic effects may result from the presence of other pollutants such as metals and organics. Temperature effects may also attract warmer water species to the area, changing the natural organism distribution either beneficially or adversely. Entrainment and impingement problems arise from drawing large amounts of marine waters with associated biota through cooling water systems. While larger fish and organisms can be kept out of cooling systems by covering intake pipes with protective screening, some organisms are injured. Those passing through the screening (the planktonic species, including fish eggs and larvae) may be totally destroyed, thereby impacting local ecosystems.

Ocean Thermal Energy Conversion (OTEC) facilities located in the open ocean will cause similar problems. In the process of generating energy, large volumes of cold, nutrient-rich bottom waters are pumped from great depths to the ocean surface, causing thermal pollution as well as impingement and entrainment problems in open ocean areas.

In FY 1978 approximately $1.4 million was spent on studies related to the pollution consequences of using marine waters for industrial and powerplant cooling, and OTEC, by DOE, EPA, NRC, NOAA, and FWS.

Almost 50 percent was directed toward evaluating temperature effects on fish, plankton, and benthic organisms. Specific studies were carried out in the Great Lakes, in the Hudson River and Middle Atlantic regions, with several studies less region-specific. One quarter of the temperature stress studies concentrated on boring and fouling commuinities.

8 percent was used for impingement and entrainment studies to evaluate the consequences of cycling through cooling water systems for planktonic organisms, including fish and shellfish larvae and eggs.

The DOE spent approximately 35 percent ($460,000) on OTEC-related environmental studies assessing potential sites for future OTEC facilities.

8. MICROORGANISMS AND PATHOGENS

The marine environment contains a wide variety of microorganisms that function in a number of important ways. These microorganisms range from true marine residents to terrestrial organisms introduced into the ocean via sewage, freshwater runoff, or other means. Some microorganisms may be potential human pathogens or pathogens of marine aquatic species; others function in chemical degradations and transformations.

Nonmarine microbial agents and organisms that can cause human disease may be present intermittently in the marine environment, but frequently do not have long-term survival. Toxins from certain planktonic organisms (dinoflagellates) normally found in the marine environment may be accumulated in shellfish and cause paralytic shellfish poisoning in man. Certain nonmarine bacteria which may be pathogenic to humans may also infect and multiply in fish in polluted environments, thus becoming vectors for reinfection of humans. A number of diseases of marine species are known to be caused by bacteria and other microorganisms introduced into the ocean. Some of these microorganisms result in high mortality to

fish, shellfish, and other species which are free living or cultured in mariculture projects.

Microorganisms are also extremely important to marine ecosystems because they assimilate, degrade, and transform a variety of natural waste materials to nutrients, a process that is necessary to the viability of the ecosystem. In addition to the "natural" role in the cyclic turnover of all major elements necessary for life, microorganisms function in the degradation and transformation of pollutants. This latter role also may be necessary in many instances for the continued heath of the ecosystem. Microorganisms, therefore, can be pollutants themselves or can serve in mitigating other pollutants and their effects.

Federal research, development, and monitoring programs directly related to pathogens and microorganisms amounted to slightly more than $1 million. It was spent by NOAA, EPA, and FDA on pathogen-related studies and development. More than 36 percent of the $1 million was directed to the development of methods for measuring pathogen levels in particulates, water, fish and shellfish, as well as developing and improving techniques and indices for assessing degree of pollution -- including the use of mollusks as indicators. 46 percent of the $ million was used to determine the effects of pathogens on fish, shellfish, and humans. Regional studies on the effects of pathogens were carried out on fish in Florida and on the causes of shellfish and larvae disease in Puget Sound.

Studies on human health effects related to swimming in recreational waters off Long Island and Lake Pontchartrain in Louisisna are continuing with the objective of setting water quantity criteria for public beaches.

NOAA is funding a study on the health consequences for divers working in polluted waters in order to developl immunization procedures, and the FDA is continuing its shellfish sanitation program to monitor levels of pathogens in shellfish collected for human consumption.

Approximately 10 percent of the $1 million was directed toward determining the behavior and fate of pathogenic bacteria and viruses in seawater, including inactivating mechanisms and methods of removal of sewage. The remaining 8 percent (approximately $84,000) is used to define the levels and distribution of pathogens in shellfish through several projects in the Gulf of Mexico and Florida, some leading to the identification of bacterial indicators as standards.

9. CHLORINATION PRODUCTS

The use of chlorine and other biocides in various water treatment processes causes the formation of many biologically active compounds. Chlorine is introduced to drinking water and waste water for disinfection, and to cooling waters of electric power-generating plants and other industrial facilities to minimize slime and other types of biofouling.

The clorine interacts with organic materials in seawater to produce chlorinated substances, and these can then react with naturally occurring bromate ion to produce brominated organic compounds. Among the compounds

formed are chloroform and bromoform, both of which have carcinogenic and mutagenic properties. The use of chlorine is expected to increase in the future, and hence it is a cause for continuing concern.

Evidence indicates that undesirable impacts on marine organisms are associated with these chlorination products. Lethal effects have been found, and shellfish which exhibit measurable uptakes of halocarbons (such as chloroform and bromoform) provide a potential route to humans for these toxic substances. Waste waters with no measurable chlorine residuals have caused measurable shifts in the colonization and composition of communities of marine algae.

Little is known about the reactions of organic materials present in waste water to the chlorination process. Additional toxic substances may result from the treatment process, or pollutants may be eliminated by conversion to harmless forms.

Approximately $750,000 was spent in FY 1978 on studies of the fate and effects of compounds formed when chlorine is added to cooling water used in coastal powerplants. 72 percent was funded by NRC, the remainder by DOE. Roughly 50 percent was directed toward identification of compounds and determination of reaction kinetics for chlorination byproducts; the rest was used to investigate toxic effects including pathways and bioaccumulation in marine and estuarine organisms. The program effort is expected to decrease by 50 percent through FY 1979 and 1980, with emphasis on fate studies increasing slightly.

10. OTHER POLLUTANTS

Two other pollutants have been identified as possible problems -- litter and explosives. Litter encompasses a variety of insoluble substances: plastics and synthetic organic materials, glass, metals, wood, petroleum products in the form of tar balls, grease balls, and natural organic matter. Litter can be found on beaches, in coastal and open ocean waters, in or on bottom sediments, and in marine organisms. Its sources include recreational activities on land and at sea, ship discharges, industrial effluents, and sewage-related additions such as storm system overflow and bypass of treatment systems.

Although litter has been found in the internal organs of marine organisms, there is no clear evidence of morbidity or mortality from its ingestion.

The accumulation and fouling of beaches by litter is a major aesthetic problem. The cost of cleanup is high, and economic losses to beach-related industries can reach annual values of tens of millions of dollars. Few quantitative studies of the types, fluxes, and persistence of litter have been made.

One project exclusively related to litter was identified. The Coast Guard is developing a solid waste incinerator for use of Coast Guard vessels. This project was funded for $91,000 in FY 1978 and $290,000 for FY 1979.

Explosives were also identified as ocean pollutants. Primary concerns are related to disposal of waste materials from ordnance manufacturing operations and the physical damage resulting from explosive testing in marine environments.

The U.S. Navy spent approximately $600,000 in FY 1978 on pollution research, development, and monitoring related to ordnance and explosives. The program is expected to decrease to $439,000 by 1980. In FY 1978 almost half was spent on evaluating the extent of hazards from explosive testing to marine organisms. The remainder was used to develop water treatment systems for removal of explosives from process plant waters and monitoring systems for explosive plant effluents.

B. Regional Efforts

This section of the analysis considers ocean pollution problems and the Federal response from a regional perspective. The regions are:

North Atlantic -- Canada-Maine Border (Northeast Channel) to Rhode Island

Middle Atlantic -- Long Island to Cape Hatteras, N.C.

South Atlantic -- Cape Hatteras to Key West, Fla., including Puerto Rico and U.S. Virgin Islands

Gulf of Mexico -- Key West to Texas-Mexico Border

Pacific Southwest -- Mexico Border to Point Conception, Calif.

Pacific Northwest -- Point Conceptioin to Washington-Canada Border

Great Lakes -- Lakes Ontario, Erie, Huron, Michigan, Superior, and the Saint Lawrence River.

Alaska -- Gulf of Alaska, Bering, Chukchi and Beaufort Seas.

Hawaii and Pacific Islands

This division enabled development of a statement of regional needs recognizing such differences as the Middle Atlantic waste disposal problem, Gulf of Mexico and Alaska oil and gas development, and the eutrophication and PCB problems of the Great Lakes. The Federal response is also focused regionally in many cases. However, that focus is usually informal and ad hoc. A stronger regional emphasis is one approach which may increase the utility of the program in future years.

1. NORTH ATLANTIC REGION

a. Introduction -- The Setting

The North Atlantic region, from the U.S.-Canada border to Connecticut, is noted for its recreational importance. It has a scenic rocky coastline in the north and wide sandy beaches along Cape Cod. The area is characterized by narrow, deep, and open inlets, cool fertile waters, and high tidal ranges. The coastal circulation is dominated locally by heavy spring runoff, but natural erosion and sedimentation are not severe problems. Due to early historic development and dependence upon marine resources, the North Atlantic region contains a high concentration of Federal and academic marine research facilities.

The area sustains important commercial fisheries for lobsters, clams, and scallops, and the especially productive fisheries of Georges Bank -- cod, haddock, herring, and flounder. Most of these fisheries are not heavily dependent on the estuaries. However, two formerly important fishery species (Atlantic salmon and sturgeon) are estuarine-dependent and are now rare or endangered.

Pollution is at present confined primarily to relatively small areas, with estuarine modification being the most pronounced problem, particularly in the Boston, Mass., Providence, R.I., and Portsmouth, N. H. areas. The well-developed ocean circulation and strong tidal currents provide a tremendous flushing capacity to this region and tend to mitigate the

effects of pollution. Local concerns are expressed over present effects of lumbering, municipal waste disposal, and wastes from fish processing operations; and the possible effects that oil and gas development will have on fisheries, recreational quality, and air and water quality.

b. Regional Needs

1. Georges Bank Oil and Gas Exploration. Assessment and monitoring of the probable effects of impending oil and gas exploration and possible development on Georges Bank on the local ecosystems and highly productive fisheries.

2. Spill Damage Assessment. Damage assessment of probable oil and hazardous materials spills to determine the need for protection of high value recreational areas and rare and endangered species habitats.

3. Powerplant and Oil Refinery Sitings. Assessment, including surveys, research on effects, and conceptual and numerical models, of proposed coastal powerplants and oil refinery sitings.

4. Waste Disposal. Assessment of environmental impacts of waste disposal near major coastal urban centers.

c. Present Activities

The total Federal ocean pollution research and development and monitoring effort in the Northeast Atlantic coastal region for FY 1978

was approximately $4.86 million. The bulk of this effort, $3.77 million (77%), was directed toward assessing possible effects of impending offshore petroleum development in the Georges Bank area. A total of $0.8 million (16%) was spent on the environmental impacts of urban waste disposal. Research on spilled oil received $0.2 million (4%). Research on coastal powerplant effluents was funded at $0.07 million (1%).

Most of the DOI/BLM effort, $3.48 million (71.6%), was directed to offshore petroleum development; DOI/USGS and DOI/FWS each funded approximately $0.05 million for research on urban waste pollution problems; EPA funding, in the amount of $0.6 million (12%), supported studies related to offshore petroleum development for 0.2 mllion, research on powerplants for $0.04 mllion, spilled-oil activities for $0.2 million, and urban waste disposal activities for $0.15 million; NOAA funding, in the amount of $0.48 million (10%), was basically directed toward urban waste effects ($0.44 million) and one Sea Grant study of coastal powerplant wastes ($0.03 million) -- the Ocean Power Program, a long-term research and monitoring study, is planned to begin in 1979; DOE funded a total of $0.2 million (4%), of which $0.125 million was for trace metal cycling in sediments and $0.067 million was related to offshore petroleum development.

d. Analysis

The major concern in the northeast Atlantic coastal area is the possible reduction of fishery resources and recreational amenities by offshore petroleum development. Potential environmental impacts and geological

hazards have been under evaluation for several years in areas where oil and gas lease sales are expected. The present Federal program appears to respond to this need adequately. Future efforts should be reevaluated, and if the likelihood of petroleum production in the area decreases, so should this program emphasis.

Damage assessment programs for possible oil spills are inadequate. If petroleum production becomes a reality, this deficiency should be corrected.

Waste-disposal-related efforts appear to be rather small and do not address urban centers equally. State efforts should be assessed, and the Federal program should be redirected in accordance with demonstrated local need.

While Federal agencies are concerned with the pollution threat imposed by powerplant effluents, most of this environmental work is carried out by the utility companies. The basis upon which to assess Federal efforts to overview the adequacy of these studies is not included in the inventory of programs associated with this Plan.

2. MIDDLE ATLANTIC REGION

a. Introduction -- The Setting

The region from Long Island to Cape Hatteras has been heavily impacted by the dense population and industrialization of the coast from Washington to New York. Its major estuaries -- New York Harbor/Raritan Bay, Delaware Bay, and Chesapeake Bay -- have undergone a considerable degradation.

Despite its myriad pollution impacts (municipal waste discharge, toxic waste disposal, dumping of sewage sludge, massive urbanization, coastal modification, etc.) the area still supports active outdoor recreational activities along its scenic coastal beaches, outer banks, inner marshes, and estuaries. Chesapeake Bay, one of the world's largest estuaries, is particularly noted for recreational attractions. It provides wintering grounds for great flocks of ducks, geese, and whistling swans. The Bay also sustains two of the most important commercial fisheries of the region -- oyster and blue crab, the latter being the largest of its kind in the world. However, productivity of the Bay is endangered by the increased runoff, sedimentation, erosion, waste disposal, dredging, and transportation-related pollution.

In the New York Bight area, the adverse effects of human activities reached such a degree that they sparked vocal public concern over the potential hazards and degradation of the environment. Events such as the fish kill of 1976 (caused by bottom-water anoxia), and the closing of Long Island beaches (because of washup of sewage wastes including grease and tarballs), have increased the public's awareness and demands for action.

The long-term effects of polluting activities on the estuaries of this region, particularly the New York Bight, are not at all understood. Perceptible changes, such as the tainting of seafood organisms and higher incidence of fish and shellfish disease, are indicators of the deleterious effects of toxic metals, PCBs, and other polluting substances.

OCS oil and gas exploration activities are being conducted in the area, and there is concern for their potential impacts.

b. Regional Needs

1. New York Bight Area. One of the most pressing needs is the requirement for sound comprehensive information upon which to base future environmental, resource, and waste-managment decisions in the New York Bight area. This should include scientific, economic, and social information. The generation of realistic but effective environmental recommendations concerning ocean outfalls, ocean dumping, and dredging are imperative, if the degradation of the environmental quality of the estuary and the adjacent waters is to be halted. A comprehensive, coordinated scientific program is needed to insure proper direction of the needed efforts.

2. Chesapeake Bay Assessment. A comprehensive assessment of Chesapeake Bay is needed in order to determine the long-term viability and sustenance of this system. Research and monitoring on the effects of agricultural and urban runoff, sedimentation, nutrients, and sewage on the estuary's biota, particularly through its aquatic vegetation, is needed in order to protect this important natural habitat and/or derive optimal socioeconomic benefits from its resources.

3. Environmental Monitoring. This coastal region, particularly around the New York Bight and Chesapeake Bay, has undergone substantial environmental degradation. A system for monitoring not only the water quality but the long-term fate and effects of pollution is an immediate need.

4. OCS Oil and Gas Development. The impact of outer continental shelf oil and gas development must be determined. A thorough assessment of all related activities affecting the area must be made so that appropriate protective or prohibitive measures can be developed. This should include surveys, research, monitoring, and modeling of the offshore and coastal systems.

5. Evaluation of Past Long Island Sound Studies. An evaluation of past studies in Long Island Sound should be considered to determine long-term trends (50 years) of the impact of human activities on this body of water. High priority should be given to evaluating the extent towhich sewage and other materials can be disposed in open water and the consequences of these actions on the living resources.

6. Assessment of Fish and Shellfish Stocks. A continued assessment and monitoring of the fish and shellfish stocks of the area must be made to protect the public from contaminated seafood.

c. Present Activities

The Federally funded marine pollution research, development, and monitoring activities in the Middle Atlantic coastal region are at a level of $18.869 million. From these funds the area centered around the New York Bight received $5.545 million (29%), the Chesapeake Bay received

$5.791 million (31%), the efforts related to the outer continental shelf oil and gas development were funded at $4.5 million (24%); the comprehensive monitoring of water quality and the long-term effects of pollution has not been initiated, and the Long Island Sound related pollution efforts received only $0.03 million (0.1%). The monitoring of shellfish harvesting areas received $2.0 million (11%).

DOI/BLM funded the offshore oil and gas development related efforts at $4.5 million (24%), DOI/USGS funded ecological studies in the New York Bight region at $0.59 million (3%); DOC/NOAA funded ecological and other pollution related studies in the New York Bight region, including ocean dumping studies, at $4.7 million (25%), in the Chesapeake Bay region at $0.12 million (0.6%), and in Long Island Sound at $0.03 million (0.1% -- Sea Grant); EPA funded the bulk of the Chesapeake Bay studies at $5.35 million (28%), and funded investigations related to ocean dumping at the level of $1.5 million (%?); HEW funded the shellfish safety monitoring program at $2.0 million (11%); DOE funded offshore oil and gas development related studies in the area at $0.6 million (3.2%); DOT/CG contributed to monitoring efforts at 0.25 million (1.3%); NASA funded monitoring related efforts at $0.3 million (1.6%); and NRC funded nuclear powerplant effluent related studies at $0.1 million (0.5%).

d. Analysis

The review of the current Federal programs in the Middle Atlantic region indicates that the funds for the three major needs -- studies

related to New York Bight, Chesapeake Bay, and OCS oil and gas development -- are nearly equally distributed and seem adequate for these areas. The major gap is the lack of a monitoring program that would look at not only those three areas, but would extend to cover the entire region as well. Additional studies on the potential environmental impacts and geological hazards may be needed for future lease sales. A review of existing State programs will be necessary to assess the level of Federal agency involvement in Delaware Bay and Long Island Sound. The current program does not take advantage of the numerous studies that have been carried out in the past in Long Island Sound.

3. SOUTH ATLANTIC REGION

a. Introduction -- The Setting

The South Atlantic Region, from Cape Hatteras, N.C., to Key West, Fla., and including the Virgin Islands and Puerto Rico, is undergoing increased coastal development and land use. This region contains an ecological range from temperate to subtropical environments. The massive estuarine system defined by the barrier islands and marshes sustains the important commercial fisheries of menhaden and shrimp. The major concern relating to the mainland is the potential loss of estuarine habitat to coastal development. Affecting the islands, there is concern about the need to use the ocean for waste disposal and the potential consequences of sand and gravel mining.

Acting on the estuaries are the destructive forces brought about by increased population pressure -- dredging, filling, channelization, and spoiling. These can occur as navigation is improved, as commercial or residential land is developed, and as refuse is disposed. All cause virtually total destruction of marsh habitat, as the marsh is filled with silt or sand or refuse to an elevation at which it no longer can survive. Thus, the effects of spoiling in the estuarine environment can best be asssed in terms of direct physical loss of habitat.

Another major stress on the estuarine systems is the nonpoint-source pollution of agricultural runoff. This and pollution from industrial outfalls and soil erosion pose threats to the environmental quality of the area.

There are few studies available on the specific effects of stresses on a salt marsh system. Although it might be possible to synthesize a model from available data to describe the effects of certain stresses on the system, the goal is still far removed.

OCS oil and gas exploration has just begun in the area and may expand, causing additional stresses on the coastal environment.

b. Regional Needs

1. Estaurine Ecosystems. An understanding of estuarine ecosystems, and their links with oceanic fishes through a comprehensive research program including laboratory and field studies and modeling, in order to determine to what extent habitat can be stressed destroyed before altering the balance within the ecosystem. Focusing on several selected habitats would be most cost effective for such a large area.

2. Nonpoint Sources of Pollution. Comprehensive studies, along the same approach as item 1, to determine the fates and effects of nonpoint-source inputs in selected estuarine systems such as those around Savannah, Ga., and Charleston, S.C., and within the barrier island system.

3. OCS Oil and Gas Development. The potential impact of OCS oil and gas development should be evaluated. A thorough assessment at all related activities impacting the area must be accomplished in order that appropriate prohibitive or protective measures can be developed. Particular concern should be demonstrated for the effects of OCS activities on estaurine dependent fisheries and offshore shellfish beds.

4. Oil Spills and Discharges off Southern Florida. Selected impact and recovery studies of oil spills and operational discharges on coral reefs, mangrove habitats, and recreational resources off southern Florida should be undertaken.

5. Sand Dredging Near St. Thomas, USVI. Assess the environmental implications of offshore sand dredging near St. Thomas and determine the effect this may have on the near-shore biota.

6. Pharmaceutical Waste Dumping Near Puerto Rico. Determine the fate and effects of the dumping of pharmaceutical wastes at oceanic disposal sites near Puerto Rico.

7. Habitat Preservation of Endangered Species. There is a particular need to perform a comprehensive study of the degree of habitat preservation (through designation of refuge areas, limited access areas, etc.) required for the propagation of endangered marine species. Emphasis should be given to ocean turtles and manatees as two species particularly suffering from coastal development.

c. Present Activities

Marine-pollution-related activities identified as specific to the U.S. Southeast Atlantic region, Puerto Rico, and U.S. Virgin Islands are funded at $6,330 million. Of this total, approximately 41% ($2,581 million) is devoted to OCS oil and gas development, and approximately 30% ($1,850 million) to concerns about estuarine modification and habitat protection -- fate (11%) and effects (6%) of nonpoint pollutants (11%), oil spills (4%), and disposal of pharmaceutical wastes in Puerto Rico (9%).

Present activities also include projects devoted to safety of seafood ($239,000) and powerplant sites in the coastal zone ($1,663,000) by DOE. This sum is approximately 29% of the expenditures in the region.

d. Conclusions -- Analysis

At present, no program addresses the problems of sand and gravel mining in the Virgin Islands. The level of effort indicated as going toward estuarine habitat and ecosystem modification ($676,000) may not be indicative of the problems in that area. Some research activities in this area may be supported by local funding sources and thus may not be reflected in the Federal inventory.

4. GULF OF MEXICO REGION

DRAFT

a. Introduction -- The Setting

The Gulf of Mexico has many important natural resources. These include the diverse environments where water and land meet. They provide habitats for fish and wildlife and present a unique setting for recreational pursuits. The extensive shoreline of barrier islands, beaches, estuarine bays and sounds, and tidal marshes support numerous water-related outdoor leisure activities. The diversity of bird life includes such rare or endangered species as the whooping crane, southern bald eagle, greater sandhill crane, and Cape Sable sparrow exists.

The dominant feature of the Northern Gulf is the Mississippi River Delta with its vast area, great river channel and flow, intricate network of lesser channels and bayous, and numerous lakes, bays, marshes, estuaries, and islands. Notable also are Tampa, Mobile, and Galveston Bays; the elongate complex of bays, marshes, and islands of the western Texas coast; and the estuaries and barrier islands of Florida, Alabama, Mississippi, and Texas.

Most of the coastal zone land has been developed for agriculture, woodland timber, urban, industrial, residential, recreational, transportational, wetlands, bays, and estuary uses. The population growth rate along the Gulf coast is greater than the U.S. average, particularly along the East Texas coast (Houston metropolitan area) and the Tampa Bay area of Florida.

An important natural resource of commercial value is the fisheries industry. In 1976 the Gulf States offshore fishery accounted for 33 percent by weight and 29 percent by value of total U.S. fisheries. On a worldwide basis, the fisheries yield in tons of the Gulf, particularly the northern area, is second only to that off the Peruvian coast. The most productive fisheries region of the Northern Gulf is around the Mississippi Delta. Approximately 30 to 40 percent of the Gulf fisheries catch is taken on the eastern side. The Gulf fishery is dominated by shellfish (shrimp, crabs, and oysters and smaller catches of clams and scallops), which generally are worth three or four times more than the much greater volume of finfish (menhaden, mullet, snapper, and others). The total commercial fisheries catch of the Gulf States is dominated (97.5%) by estuarine-dependent species (fish or shellfish that spend all or part of their lives in estuaries).

As of March 1977, 7.8 million acres of coastal and offshore area were held under active lease for petroleum production. Of this acreage, 42 percent is now producing, mostly in offshore Louisiana and Texas. As of February, 1979 there were more than 16,000 exploration and development wells drilled in the Gulf of Mexico OCS. More lease sales are expected.

The Gulf is the site of numerous nearshore and deepwater (400 fathoms) dumpsites for disposal of dredged material and explosives, and has been the site for toxic chemical and industrial wastes disposal. The Gulf also was the location of the experimental shipboard incineration of organochlorine and other toxic chemical wastes. Consideration is being given to using an offshore rig as a hazardous material incineration site.

The diversity and extent of uses of the Gulf have placed heavy demands on the region's resources.

The most significant source of pollution is that carried into the Gulf by the Mississippi River. Drainage from more than 5.5 million km^2 or 41 percent of continental U.S. land is into the Gulf. There are high levels of organic pollutants in sediment of the Mississippi Delta area. The impact of this pollution on the marine resources of the Gulf is little understood. Until recently, it was overlooked.

b. Regional Needs

1. Nonpoint Source Pollutants from the Mississippi River. A scientific program is needed to determine the effects of the nonpoint-source pollutants carried by the Mississippi River into the Northern Gulf. The Gulf waters, sediments, and biota are assimilating large quantities of toxicants. Their fates and effects need to be identified.

2. Long-Term Effects of Petroleum Development. A post assessment program is needed to determine the long-term -- more than 25 years -- effects of petroleum development on living resources, and on the offshore and nearshore environments. Thorough chemical, biochemical, and geological analyses of the significant constituents of the biota, water, and sediments are needed for historical ecological comparisons. They should prove useful in ongoing assessments.

3. Louisiana Wetland and Estaurine Assessment. A comprehensive assessment is needed on the effects of wetland and estuarine modification along the coast of Louisiana. Information is needed on the cumulative effects of channeling, dredging, filling, and spoiling in the massive wetlands areas. The extent to which physical alteration can continue before productivity of the ecosystem is permanently lost must be evaluated.

4. Petrochemical Industrialization on Galveston Bay and Texas Coast. The long-term effects of increasing petrochemical industrialization on Galveston Bay and the Texas coast are not well understood. A focus of field and laboratory research and monitoring for long-term assessment is needed to protect the aquatic environment and public health.

5. Development in West Florida Coastal Embayments. A comprehensive study is needed to determine the long-range effects of increasing coastal development on the West Florida coastal embayments. To what extent can an area, such as Tampa Bay, assimilate the impacts of urbanization and industrialization?

6. Disposal of Brine from Salt Dome Storage Sites. There is a need to monitor and study the dispersion of brine disposal from salt dome storage sites for the Strategic Petroleum Reserve.

7. Drilling Mud Discharges on the Flower Garden Banks. The monitoring and assessing of effects from drill-mud discharges and other OCS-related activities on the Flower Garden Banks should be undertaken. The Banks are a unique recreational and marine wildlife habitat in the offshore Gulf waters and are being considered for designation as a marine sanctuary.

c. Existing Programs

Research and monitoring programs and projects dealing specially with coastal and offshore Gulf of Mexico received over $11 million in Federal

funds in FY 1978. Oil and gas development and production has been a major coastal and offshore activity for many years. Funds related to this activity were nearly $6 million, or one-half the total for the region. In addition to this Federal interest, significant efforts also were directed to offshore brine disposal for Strategic Petroleum Reserves (SPR), $2.5 million, and problems of wetland alteration and use, approximately $1 million.

The study of pollution related to oil and gas operations is supported for the most part by the Department of the Interior (DOI) and EPA. Both agencies are funding studies on the assessment of long-existing oil fields off Louisiana and Texas, respectively. Total funding for these efforts is approximately $2.5 million. Projects studying effects of drilling muds on biota, and conducting reconnaissance and monitoring of unique and sensitive environments (e.g., the Flower Garden Banks) amount to over $2 million. Three other ongoing environmental surveys funded by DOI/BLM total nearly $1 million.

The Department of Energy is funding $2.5 million in studies dealing with research and monitoring of the effects of offshore disposal of brine from onshore salt domes. Brine disposal and OCS oil and gas activities are the principal Federal programs in the Gulf.

The problems of wetland and estuarine alteration are being studied by the Army Corps of Engineers. Several individual projects are funded

through NOAA Sea Grant. Of the combined Federal effort (over $1 million) in this area, approximately $400,000 is for development of an information base (DOI/FWS).

Problems related to ocean dumping of municipal and industrial wastes in the Gulf of Mexico received nearly $400,000 through NOAA projects.

Several projects are addressing the distribution and effects of pesticides and trace metals along the coast and in the estuaries. Also, fishery products are being monitored for contaminants. The total funding for these studies is less than $1 million through several Federal agencies.

Problems associated with the coastal development of West Florida and pollution of Galveston Bay have identified funding of approximately $200,000 and $100,000, respectively.

d. Analysis

In terms of level of funding, the above listed needs receiving the greatest and most concerted effort for the Gulf of Mexico are: Need #2, postassessment of petroleum development, Need #6, research and monitoring of salt brine disposal, and Need #8, effects of drilling muds, particularly with respect to Flower Garden Banks. The adequacy of these efforts must be judged in the future. Coordination between programs is essential now.

The Mississippi River outflow presents many problems that require study (Need #1). In FY 1978 no major program was addressing the capacity of the Gulf of Mexico system to handle the pollutants carried by the river. Several individual projects addressed the various pollutant

components found in the Mississippi, or in neighboring estuaries, but these are considered inadequate to assess synergistic and cumulative effects.

Projects assessing wetland modification (Need #3) are inadequate in scope or magnitude to define the problems arising from pressures and stresses on this system. A concerted, coordinated effort is needed. The evaluation is impaired by lack of information on State-supported programs.

Galveston Bay (Need #4) is the site of considerable industrial and municipal impact. The level of funding devoted to these problems was insignificant in FY 1978. Efforts devoted to development of West Florida coastal areas (Need #5) also appear to be insignificant.

Ocean dumping activities in the Gulf are declining; however, projects are funded on the fates and effects of pollutants. The results will have general application to similar pollutant problems, but continuation of this effort is not needed for the Gulf.

5. PACIFIC SOUTHWEST REGION

a. Introduction -- The Setting

The Pacific Southwest Region (Mexico/California border to Point Conception, Calif.) is characterized by a narrow continental shelf and a continental borderland off southern California. Because of the narrow continental

shelf, periodic upwelling of deep water close inshore -- as winds force the California Current offshore -- brings cool, fertile water near the coast for several months of the year. The coastline has a typical beach and bluff configuration and only a few shallow embayments.

Southern California is densely populated and supports areas of concentrated industrial development. Recreation, shipping (particularly petroleum transportation), oil and gas development, and municipal and industrial waste disposal are intense in this region. Commercial and sport fisheries, bird and mammal migration routes, kelp beds, and recreation areas are the major resources at risk.

There is a high level of ecological awareness and environmental concern in the Pacific Region. This concern is reflected by extensive State and local programs, which are designed to provide the best balance between commercial development and the preservation and enhancement of environmental quality.

Current oil and gas exploration and development activities in the area result from anticipated lease sales.

b. Regional Needs

1. Petroleum and Mineral Development. Assess the impacts of pollutants associated with petroleum development. Pollutants associated with energy, and mineral development, transport, and use, will increase in importance and warrant close scrutiny. Southern California is being considered as a port of entry of Alaska oil, LNG, and new offshore oil drilling operations.

2. Nonpoint Source Impacts. Determine the effects of nonpoint-source pollutants on coastal ecosystems and evaluate the contributions from agricultural chemicals, runoff, aerial fallout, and vessel wastes.

3. Point Source Ocean Outfalls. Continue investigation of the ecological implications of waste disposal at point-source ocean outfalls in southern California and nonpoint sources (atmospheric fallout, runoff) along the southern California coastal zone.

4. Impacts of Geohazards on OCS Petroleum Development. Examine the potential impacts of geohazards on OCS petroleum development.

5. Impacts of OCS Petroleum Development on Critical Habitats. Assess the potential impacts of OCS petroleum development on offshore critical habitats, particularly the Channel Islands, Santa Barbara Channel, and Tanner/Cortes Bank areas.

c. Present Activities

Existing programs address the impacts of OCS oil and gas development on offshore critical habitats, the impacts of pollution associated with energy development, and the impacts of transshipment activities on the southern California environment.

The total expenditure for the region is $1.2 million. Of the total, nearly 60 percent ($666,000) is being spent on addressing and evaluating the potential pollutant impacts of OCS petroleum development on offshore critical habitats, particularly the Channel Islands, Santa Barbara Channel, and Tanner/Cortes Bank area. The Environmental Protection Agency is funding a project (at a level of $200,000) to establish a complete environmental data base for the Santa Barbara oil-lease area and the effects oil extraction and transport will have on coastal ecosystems. Another significant effort addressing this need is a DOI/BLM-sponsored project (funded at $546,000), which will provide a biological characterization and geological reconnaissance survey of the Southern California Bight areas of current and proposed oil and gas leases.

Another study addresses erosion, and transport of sediments and pollutants, on the San Petro shelf off southern California. This project is funded at $224,000, approximately 30 percent of the expenditure for the region. It specifically addresses Need #1 -- the potential impact of new OCS drilling operations on the nearshore environment.

Other activities in the region (<10%) address the nonpoint-sources of pollutants and geohazards associated with OCS drilling and pipelines. One activity, funded at $33,000, addresses the effects of thermal effluents on the biota. This was not identified as a regional concern.

d. Analysis - Conclusions

The regional needs expressed by concern about the effects of nonpoint-source pollutants on coastal ecosystems, and problems associated with the ecological implications of pollutants at point-source outfalls off San Diego, Santa Monica, and Santa Barbara, may not be given proper support. Although considerable work has been done in the past to assess the potential impacts of transshipping Alaska crude oil to west coast ports, this work should be coordinated in an overall assessment.

It is recognized that the Southern California Coastal Water Research Project (SCCWRP), located in Los Angeles, has been performing comprehensive studies of the environmental impacts of marine waste disposal in the Southern California Bight for several years.

6. PACIFIC NORTHWEST REGION

a. Introduction -- The Setting

The Pacific Northwest Region, Point Conception, Calif.,to Washington/ Canada border, has a continental shelf and coastal configuration similar to the Pacific Southwest. Its ocean water temperatures are lower, and movement of the California Current away from the coast is less pronounced. Because of the greater rainfall, some major rivers cut through the coastal mountains to form deeply embayed estuarine systems. Extensive erosion and sedimentation have produced the wide tidal flats, bars, and shoals typical of estuarine systems. With the exception of San Francisco Bay, Tornales Bay, Coos Bay, and Puget Sound, effluents in the rivers tend to be carried directly offshore.

The Straits of Juan de Fuca and Puget Sound, which were glacier formed, do not have as severe erosion of sedimentation as along the ocean coast, and have retained much of their original configuration. The Straits and Puget Sound are a classical estuarine system, and a potential site for polution problems, particularly if the area is chosen as a transshipment point for Alaska oil.

Fishes of importance in the Pacific Northwest zone include all five species of Pacific salmon and many other anadromous and marine fish and shellfish. Harbor porpoises, sea lions, and harbor seals are the common marine mammals. Sea otters have been reintroduced to coastal waters of Washington. The rare humpback whale frequents bays and estuaries.

The Region has a number of effective environmental programs but is not free of pollutants and their impacts. There is concern about the discharge of industrial and municipal effluents to waters of San Francisco Bay and Puget Sound, their input rates, fates, and effects. The discharge of wastes from various sources (including pulp and paper mills in Puget Sound) subject the estuaries to a variety of chemical compounds that are potentially detrimental to the marine biota and humans. Some of the contaminants have a direct and obvious impact on the biota (especially at higher concentrations); others have a more subtle, indirect effect. Some have no discernable effects at present concentrations, but may have chronic effects if introduced over a long period.

The possibility of future OCS oil and gas development is uncertain at present; however, lease sales have been scheduled for the area.

a. Regional Needs

1. Effects of Multiple-Source Pollutants on Sensitive Habitats. Identify and assess the impact of multiple-source pollutants on sensitive habitats of migratory marine species. A highly coordinated effort is required to identify and control pollution of coastal habitats of marine species (birds, mammals, and anadromous fish) in the Pacific Northwest. The continuity of these species requires successful completion of their entire life cycle. Protection of a migratory species in the marine environment is futile if its life cycle is interrupted by pollution of its freshwater/estuarine habitat.

2. Effects of Effluents on Puget Sound and San Francisco Bay. Identify and characterize the major marine components and processes of the Puget Sound and San Francisco Bay ecosystems which are involved in critical environmental problems related to industrial and municipal effluents.

3. Petroleum Development. Examine the potential impact of OCS petroleum development and transshipment on sensitive coastal habitats and identify the potential geological hazards.

4. Monitoring the Farallon Islands Low-Level Radiation Disposal Sites. Continue monitoring of low level radiation disposal site near the Farallon Islands to assess the dispersion, accumulation in the biota, and possible transfer to man of these pollutants.

5. San Francisco Bay Dredge and Fill Activities. Provide a study of the historical, current and planned dredge and fill activities in San Francisco Bay and describe the exosystem impact of these coastal alterations.

b. Existing Program

The total Federal effort in the Pacific Northwest Region exceeds $4 million. Approximately two-thirds of this effort is directed to specific regional needs -- the Puget Sound ecosystem, $1.44 million; the San Francisco Bay ecosystem, $0.77 million; OCS geohazards, $0.38 million; and habitats of migratory species, $0.22 million (all wetlands research).

Several DOE studies (funded at approximately $0.75 million) may represent a cohesive program on the fate and effects of Columbia River derived radionuclides, but this is not clear from available information.

Other small efforts include ecosystem chracterization, the "mussel watch" programs, and carcinogens in marine invertebrates.

The USGS conducts the major studies of the San Francisco Bay, which focus on the circulation, sedimentology, and geochemistry. EPA and NOAA provide major support for the Puget Sound efforts.

c. Analysis

The Puget Sound program addresses a regional need and is a well-balanced multiagency effort. The San Francisco Bay effort appears to lack a program element dealing with fate of pollutants and their effects on living resources, although State and local programs may address this need. There are minimum efforts devoted to the OCS program; however, OCS oil and gas lease sales have been scheduled within the next 5 years. Efforts to assess the effects of pollutants on critical habitats of migratory marine species are minimal and restricted to wetlands research.

7. ALASKA REGION

a. Introduction -- The Setting

Alaska's extensive coastline and corresonding coastal estuarine systems are one of the State's most important resources. They are biologically productive and are used for many purposes. They serve as nurseries, spawning and feeding grounds, and passageways between the open sea and spawning areas of freshwater streams. Most of the commercial seafoods harvested in Alaska are associated with coastal estuarine systems. These systems also provide habitat for numerous species of sea birds and marine mammals.

Increased petroleum production and transport of oil products through Alaska's coastal waters have increased the risks of pollution. Many more oil and gas lease sales are anticipated. Minor problems, which are evident, include wastes from municipalities and from activities of the petroleum, timber, pulp and paper, and fishing industries.

Significant pollution of Alaska's coastal systems by oil has not yet occurred. The most immediate problems appear to surround the 800-mile Trans-Alaska pipeline, which brings oil from the oil-rich North Slope to the ice-free tanker terminal at Port Valdez in south-central Alaska. The coastal systems in the region are particularly vulnerable, especially Port Valdez, Valdez Arm, and other systems located in Prince William Sound.

Among Alaska's most important industries, now and in the future, are those involved with its forests -- their harvesting and processing. Coastal pollution problems originating from the logging industry are apparent in southeast Alaska. The discharge from pulp mills has seriously affected water quality in certain southeast Alaska bays. A serious degradation of water quality caused by inadequately treated wastes from pulp mills in Ward Cove and Silver Bay has been documented.

Wastes from the fish processing industry also have caused serious degradation of water quality and prevented various other important and economic uses of that water.

Only isolated cases of decline in water quality caused by the discharge of municipal sewage into the sea have been documented.

b. Regional Needs

1. Ice Damage in the Beaufort and Chukchi Seas. Determine the potential of ice to damage nearshore structures and pipelines in the Beaufort and Chukchi seas. In the nearshore zone, there are many pressure ridges in the fast ice. Ice shove, and overriding of beaches, by as much as several tens of meters in distance, occurs regularly in some areas. The gouging of the ocean floor, by the keels of the pressure ridges and ice islands, also is a potential hazard.

2. Clean-up of Oil Spills in Ice-Covered Regions. Develop new technology, including biodegradation, to control and clean up oil spills in ice-covered regions. There is some hope for effective cleanup in summer, if not too much ice is present, less hope for tackling spills under fast ice, and no available method for cleanup of spills in moving pack ice.

3. Sand and Gravel Removal on the Beaufort Sea Coast. Determine and assess the impact of removal of sand and gravel for construction in the Beaufort Sea coastal zone. Barrier islands are part of this dynamic system, and their stability and usefulness as habitats may be threatened by demand for gravel. Careless removal of gravel from river bottoms also can affect critical habitat for the overwintering of fish.

4. Petroleum Degradation by Microorganisms. Determine the role of microorganisms in degradation of petroleum in Arctic coastal environments.

5. Petroleum Development Effects on the Bowhead Whale. Evaluate the threat of petroleum development to the bowhead whale in Arctic waters. There are great uncertainties about the endangered bowhead population, their reproduction, migratory routes, and overwintering range. Although possibly not threatened by low concentrations of oil, the bowhead whale population may be threatened by humans and their activities.

6. Pollutant Effects on Sensitive Habitats. Assess and predict the potential effects of pollutants on sensitive habitats. For example, the ice edge, which has been shown to be biologically important, would be likely to concentrate and trap spilled pollutants in its many leads and irregularities. The Pribilof Islands are a sensitive habitat that must be carefully protected.

7. Logging, Pulp mill, and Fish Processing Effluents. Determine the effects of logging and pulp mill and fish processing effluents on water quality and ecosystems.

8. Geological and Physical Hazards. Study the effects of geological hazards on shipping, structures, and pipelines, particularly on Cook Inlet, Prince William Sound, and the Beaufort Sea. Although experience with offshore oil development in the northern part of Cook Inlet has shown that environmental hazards that are less destructive than major earthquakes can normally be dealt with, it is clear that Cook Inlet structures and pipelines will be subjected to strong tidal currents, high rates of sediment movement, active faults and seismic activity, and the action of ice during the winter months. Petroleum transport and storage activities in Prince William Sound are vulnerable to seismic activity, ice hazards, and tsunamis. Subsea permafrost can be a hazard to coastal and offshore structures in the Beaufort Sea.

c. Existing Program

The marine pollution program in Alaska is funded at a greater level than for any other region, exceeding $20 million in FY 1978. The program is almost entirely funded by BLM and managed by NOAA's Outer Continental Shelf Environmental Assessment Program (OCSEAP). Other Federal agencies (EPA, USGS, USCG) contribute limited funds, as do the State of Alaska and private industry. Because of Alaska's harsh environment and vast distances, program support costs are large. They account for nearly 40 percent of the program expenditures.

Of the remaining $13 million effort, over 50 percent is devoted to environmental characterization and biological effects studies. These types of studies, involving ecosystem characterization, food-web dynamics, concentration and effects of pollutants, and physical oceanography, while not unique to Alaska, are particularly applicable in poorly understood, pristine subarctic and arctic areas.

The balance, $5.6 million, is devoted to environmental problems peculiar to, or highly characteristic of, the Alaskan regime.

d. Analysis

Each cited need is addresssed by the current program, with the exception of specific studies on the effects of sand and gravel removal in the Beaufort Sea. The efforts addressing Need #5 and Need #7 are

notably small. The contribution of State and private funds to these needs is unknown. The large effort directed at environmental characterization of the Alaska regime is subject to evaluation in terms of program priorities, especially in view of the 4- to 5-year effort conducted in this area. The large geoenvironmental hazards project is also subject to reexamination in view of the limited success in discovering and completing new producing wells; however environmentally sensitive areas should continue to be identified.

8. HAWAII AND PACIFIC ISLANDS REGION

a. Introduction -- The Setting

The Pacific Islands Region includes the Hawaiian Islands, Eniwetok (the former weapons testing area),
and Marshall Islands -- tropical oceanic islands of volcanic origin. Dominating factors are lack f a continental shelf, full exposure to oceanic conditions, and warm air and water temperatures. Coral reefs and beach and bluff configurations are typical.

Hawaii is a potential site for processing deep sea-bed manganese nodules. Concerns are environmental impacts of tailings and mineral processing effluents. Residual radioactivity at Eniwetok is a matter for concern, with particular emphasis on long-term fate and effects.

b. Regional Needs

1. Seabed Mineral Extraction and Processing. Assess the impacts of pollutants associated with potential deep sea-bed mineral extraction and processing development.

2. Radionuclides in Areas of Former Weapons Testing. Assess the fate and effect of radionuclides in areas of former weapons testing.

c. Existing Program

The Federal program in Hawaii and the Pacific Islands was funded at just under $2.5 million for FY 1978. Two projects dominate the program effort. The NSF, with some DOE contribution, funds studies of the atmosphere-ocean transfer of metal and organic pollutants, with ancillary studies of circulation, and fate and effects of radionuclides in corals and ground water. These studies are conducted principally at Eniwetok atoll ($1 million plus).

The second major effort is the Deep Ocean Mining Environmental Study (DOMES) conducted south of Hawaii by NOAA. This project examines the physical and biological effects of seabed disturbance and particulate plumes generated by prototype mining activities (approximately $1 million).

A small NOAA-funded effort examines the role of pathogenic bacteria and viruses from sewage in degradation of water quality in Hawaiian waters.

d. Analysis

The Federal program appears to address the principal concerns in this region. There are two possible exceptions. If the level and economic climate for deep-ocean mining of manganese nodules improves substantially, consideration should be given to: (a) the impact of full-scale, multiyear mining on the marine environment in the mining area; and (b) the nearshore impact to the Hawaiian Islands of a mineral processing facility and its effluents.

9. GREAT LAKES REGION

a. Introduction -- The Setting

Until recently, the Great Lakes have been viewed as a virtually inexhaustible supply of high-quality water. However, increasing population, and advancing technological innovation and intensification of water and land use in the Basin, have resulted in a continuing degradation of the lakes. Although the Great Lakes are an interconnected system, each basin is unique in terms of its limnology, the socioeconomic characteristics of its communities, the type and degree of pollution, and the kinds of control measures required.

In the Great Lakes region the causes for deterioration of water quality include: eutrophication, caused by phosphorous input from land runoff and atmospheric fallout; sediments, carried in by erosion, dredging, and watershed runoff; pesticides, heavy metals, industrial organics, and

PCBs, often carried together with sediments; and bacteria and viruses, introduced by sewer overflows.

b. Regional Needs

1. Multiple Pollutant Inputs. Monitor and analyze the multiple inputs of pollutants in the Great Lakes. Pollutants are not derived uniformly from whole watersheds or even subbasins. The relative importance of pollutant sources from each watershed is important, but not sufficient to define the resultant multiple inputs to the Lakes.

2. Diagnostic Management Models of Pollutant Fates and Effects. Develop diagnostic management models of the fates and effects of pollutants entering the Great Lakes. Available information on inputs and ecosystems need to be integrated to determine pathways, fates, and effects of pollutants.

3. Fates and Effects of Pollutants from Diffuse Sources. Monitor the fates and effects of the diffuse pollutant inputs to the Great Lakes, with particular emphasis on transformation products, remobilization products, and synergistic effects. In order to determine potential hazards to human health and lacustrine biota, and to assist in the development or refinement of control strategies and environmental indicators, surveillance of pollutant fates and effects must be maintained.

c. Present Activities

The current Federal effort in the Great Lakes Region is primarily devoted to monitoring the fates and effects of pollutants. This amounts to approximately 66 percent of the total funds expended in the region ($6 million). The majority of this ($5 million) is in response to the Great Lakes Water Quality agreement by Canada and the United States. This is a joint program between the two countries to effectively

manage the resources of the Great Lakes basin. The U.S. participation in this activity is primarily carried out by EPA. In addition, DOI/FWS supports research on the effects of pollution on living resources of the Great Lakes ($820,000), and the NOAA/Sea Grant Program supports research through various universities in the area ($350,000). This research is attempting to determine levels and fates of toxic chemicals (especially PCBs) in the ecosystem.

NOAA, through the Great Lakes Environmental Research Laboratories (GLERL), is funding $2,538 million in research efforts to develop diagnostic models of the fates and effects of pollutants in the Great Lakes. This amounts to approximately 33 percent of the total effort in the Great Lakes Region.

d. Observations -- Conclusions

At the present time, there appears to be adequate support for monitoring pollutants in the Great Lakes. This activity also is supported by several bordering States and Canada. The level of effort for developing and evaluating diagnostic management models could be expanded to broader areas of the lakes. The level of support for monitoring multiple inputs of pollutants to the Great Lakes, especially the nonpoint sources, does not appear to be adequate.

C. Sources of Pollution

In the previous section the Federal program was viewed from the receptor aspect-marine resources impacted by pollution. Now the emphasis shifts to human activities that create the problem -- sources of Pollution. This section focuses on needs and Federal response to pollution from specific marine activities; waste disposal, marine energy, mineral resources, marine transportation, recreation, and fishing.

1. COASTAL LAND-USE PRACTICES

Most sources of ocean pollution, exclusive of marine transportation and OCS oil and gas development, result from man's land use practices. These activities yield pollution from: 1) nonpoint sources such as urban runoff and agricultural land use, 2) siting of coastal industrial, domestic, and energy facilities which results in concentrated aggregations of multiple point sources of pollution, and 3) wetlands modification through dredging and filling of wildlife habitats and fisheries breeding grounds. These ocean pollution sources contribute much of the pollutant load to the coastal oceans and are much more difficult to control than individual point sources.

a. Habitat Modification

Physical alteration of wetlands through dredging and filling, navigation channel development, jetties, breakwaters, and other coastal facilities can adversely affect water circulation patterns and living resource

habitats. Physical alteration of the coastline by these activities may jeopardize the fisheries resources of the ocean which depend on these areas for nursery and breeding grounds. As with facility siting, these activities are often progressive and insidious and the overall impact may not be recognized due to consideration of individual projects on a case-by-case basis. For example, less than 400,000 acres of California's original 3.5 million acreas of wetlands remain today. At least 50 percent of Connecticut's tidal marshes have been destroyed, and the remaining 14,000 acres are being encroached upon at the rate of about 200 acres per year.

Needs

Physical and Biological Effects. Determine the physical and biological effects of dredging and channelization in the coastal zone on a site specific basis.

Reduction of Aquatic Vegetation. Determine the effects of reductions in aquatic vegetation (marshes, swamps, mangrove forests, seagrasses, etc.) on productivity and survivability of marine living resources.

b. Nonpoint Sources of Pollution

For the purposes of the Federal Plan, nonpoint sources of pollution are defined as those sources of ocean pollution not amenable to treatment as point sources in the context of P.L. 95-273. This includes 1) urban runoff which carries sediments, litter and animal droppings, atmospheric fallout from industrial stacks and the residue of automotive transportation (lubricants, asbestos, and lead) into the ocean, 2) agricultural runoff which carries fertilizer residue, pesticides, sediment and animal wastes, and 3) the aggregate contribution from many upstream point sources resulting

from river discharges, to estuaries and the marine environment. This last category is an artificial one resulting from the definition of "marine environment" contained in the Act. That definition sets the landside boundary at the upstream limit of estuaries. Thus, for the purpose of the Act, the aggregation of all upstream point sources appears as a nonpoint riverine discharge. As a result, much work being done to assess inland point source pollution of rivers will not be reported. It should be noted, however, that the Great Lakes are included in the marine environment for the purposes of the Act and that work will be reported in the description of the current Federal program.

Needs

Regional Inventory. Develop and maintain a regional inventory of upstream sources of ocean pollution, including municipal and industrial outfalls, agricultural and urban runoff, dredging and dredge spoil disposal operations, port operations, and recreation.

Existing Pollutant Levels. Determine existing levels of critical ocean pollutants in estuaries on a regional basis.

Pollutant Input and Flux Models. Develop general models for input and flux of pollutants through the narrow coastal region (wetlands and bays out to three miles offshore).

c. Facility Siting

The threat of ocean pollution from location of industrial facilities and urban development in the coastal zone often develops incrementally. One more house, factory, or store seldom is the key to total degradation of the marine environment. However, the aggregate of all these uses does significantly alter and degrade the environment.

Although some progress has been made, planning for coastal development is often done on a facility by facility basis with no consideration of the aggregate impact of multiple sources of ocean pollution in one area. Lack of a preplanned listing of acceptable sites for particular coastal facilities often hampers necessary development activities and results in prolonged litigation as the evaluation process mandated by the National Environmental Policy Act is carried out on a case by case basis. A similar lack of identification of particularly ecologically sensitive areas in the coastal zone often results in a poor initial choice of facility location which is only discovered much later in the development process at great cost to both the developer and the public at large.

Needs

Site Selection Guidelines. Develop use specific guidelines for coastal facility site selection which take account of environmental, health, safety, and socio-economic impacts.

Impact Assessment Methods. Develop methods for adequately assessing the overall impact of multiple facilities in a specific geographic region and carry out these assessments in selected areas.

Present Activities

Almost $20 million was spent in 1978 by EPA, NOAA, DOI, and the Army COE for studies related to coastal land practice. EPA spent the greatest portion of this, more than $15 million, primarily for studies in the Chesapeake Bay and Great Lakes where major programs are investigating the impact of land runoff in these confined water bodies. Circulation and flow models related to assessing pollutants entering various estuarine systems were carried out by the USGS.

Several small projects totaling $84,000 were focused on inputs of pollutants through atmospheric pathways; the remainder of the studies were carried out on a site specific basis in areas such as San Francisco Bay ($400,000), Coastal areas in Florida ($100,000), Barataria Basin ($120,000), Great Lakes, and Chesapeake Bay.

The FWS carries out a national pesticide monitoring program for fish and game in coastal areas.

Almost $1.4 million of the $20 million was directly related to habitat modification studies. More than half was directed toward evaluation of physical alterations and sediment movement in coastal areas; less than 15 percent was used to study biological implications such as primary productivity, food web transfers, and relationships between marsh vegetation and estuary health, outside the Chesapeake Bay. (The Chesapeake Bay Program, funded by EPA, is a comprehensive study of the bay and its problems including aquatic vegetation.)

Analysis

1. Land use practices in the coastal zone are probably the greatest single influence on pollutants entering the oceans. This aspect of the Federal program is grossly underemphasized. While some work has taken place at regional levels; it is not coordinated for multipurpose application and little overall direction is provided at any level. A coordinated national effort to inventory sources of pollution entering the ocean, through coastal areas, and develop models for pollutant influx should be undertaken.

2. Efforts to develop guidelines for coastal facility site selection should be continued and new methods for assessing overall regional impact should be initiated.

3. Assessment of the role of aquatic vegetation in local ecosystems should be continued as required for areas of special concern.

2. MARINE WASTE DISPOSAL

a. Sewage Sludge Dumping

National policy under the Marine Protection, Research, and Sanctuaries Act (P.L. 92-532) requires that all ocean dumping of sewage sludge be phased out by 1981. As of 1978, this requirement is well along toward implementation. Therefore, the research, development, and monitoring needs described below are restricted to existing ocean disposal sites used for sewage sludge, and related to present and pending litigation. A relatively low level of funding is recommended to meet these needs. It is anticipated that they will be met during the initial 5-year planning period.

Needs

Pollution Identification. Complete the chemical identification of sludge pollutants at existing sludge dumpsites.

Pollutant Transport and Fate. Complete oceanographic studies of fractionation, dispersion and distribution of sludge pollutants within the water column and bottom sediments.

Metals and Synthetic Pollutants. Complete studies of bioaccumulation of heavy metals and synthetic organic pollutants attributable to sludge dumping.

Dumpsite Monitoring. Perform ecosystem recovery studies at representative phased-out dumpsites to determine time and degree of recovery, and residual pollutant abundance, distribution and ecological effects.

Risk to Human Health. Perform a risk assessment of human health consequences of sludge dumping at sea in such terms as can be compared to similar risk analyses of land disposal practices.

Present Activities

In FY 1978 EPA spent $620,000 to survey the two active sewage sludge dumpsites -- in the New York Bight and in Delaware Bay.

The New York Bight site was monitored by EPA Region II to determine possible degradation of the site from dumping practices. In addition, studies of bathing water quality at New Jersey and Long Island beaches are performed every summer to determine their microbiological acceptability for water contact sports.

EPA Region III performs quarterly oceanographic surveys of water and sediment quality at the Philadelphia sewage sludge dumpsite located approximately 50 miles off the Delaware Coast.

In FY 1978, $150,000 of the total $620,000 funding was applied to developing the information necessary for writing Environmental Impact Statements for the two existing sludge dumpsites.

Analysis

Monitoring of active and phased out dumpsites should continue with emphasis on human health effects to determine recovery rates and ability of the oceans to absorb sewage sludge wastes.

b. Municipal Sewage Outfalls

In addition to development of advanced sewage treatment technologies and alternative disposal methods, the 1977 Federal Water Pollution Control Act Amendments require monitoring and evaluation of coastal municipal outfalls that are exempt from secondary sewage treatment requirements. This monitoring is required for a 5-year period -- the duration of each allowed exemption. In 1983, renewal of the exemptions will depend upon analyses of the monitoring data. For renewal, the analyses of data must demonstrate that the outfall in question produces no adverse impact on the balance of the ecological community surrounding it. The outfall must continue to meet other chemical effluent standards established by regulation. Research, development, and monitoring needs for municipal sewage outfalls, including those which discharge mixed domestic and industrial wastes, are as follows:

Needs

Pollutant Movement and Alteration. Information is needed on chemical and physical processes which disperse, concentrate, and cycle municipal waste pollutants in the ocean. Knowledge of these processes is needed to evaluate and determine requirements for discharge permits under EPA's NPDES program. Facts concerning inshore chemical and physical processes can be used to improve the scope, accuracy, and precision of predictive evaluation of discharge permit applications. Predictive evaluations should include analyses of natural phenomena such as currents, winds, and wave conditions which affect pollutant distributions as well as effects on ecosystems of the important pollutants.

Synthetic Organic Pollutants. It is necessary to determine the identity, source, distribution, persistence, and bioaccumulation of synthetic hazardous chemicals in the marine environment, including food web transfers and possible pathways to man. Chlorination products from disinfection processes and antifouling compound residuals should be included in this investigation.

Outfall Monitoring. We should determine the efficiency and value of differing sewage treatment practices in order to choose among them; studies of the degree and rate of recovery of outfall polluted environments after treatment is applied or discharges are removed should be performed.

Biostimulant Research. Municipal sewage outfall discharges contain large amounts of biostimulant nutrients which could overload the nutrient assimilation capacity of receiving wastes. To improve our ability to choose waste treatment and outfall sites, we must be able to evaluate nutrient characteristics of particular inshore marine ecosystems, separating natural from manmade variations and accurately determining the degree and persistence of change that any proposed municipal discharge is likely to produce. Evaluations should include ecological and economic effects as well as sources, dispersion, persistence, abatement technologies, and risk assessment protocols.

Sediments. We need to develop standard methods and criteria for determining the pollution content of sediments so that we can choose suitable treatment technologies and strategies. Knowledge of polluted sediment effects upon diverse marine ecosystems such as coral, seagrass, kelp, and bottom invertebrate systems is needed. Migratory fishes and groundfishes in coastal waters are also affected by polluted sediments, and these effects require ecological and economic evaluation as well.

Microbial Pollutants. Municipal sewage outfalls cause health and ecological risks by introducing microorganisms into the marine environment. These risks must be determined. Areas of research and development and monitoring include sources, identification of dangerous species, persistence, transformation, measurement, diagnosis of health and ecological effects, development of risk protocols, and prevention of microbial contamination of the marine environment. Costs and benefits of abatement and prevention technologies should be determined.

Municipal Waste Treatment Technology Improvement. We need to reduce the volume and kinds of pollutants which reach the ocean. To do this, advanced alternative waste treatment technologies need to be developed, particularly for geographic areas of immediate hazard such as connecting channels of the Great Lakes and broad continental shelf zones of the Atlantic and Gulf coasts. Technological, ecological, and economic costs and benefits of such technologies should be determined at the pilot feasibility stage or before.

Monitoring Strategies. Monitoring sewage outfall effects in marine water traditionally has been a one-at-a-time, BOD, suspended solids and floatables effort, which has ignored the individual and cumulative effects of outfalls upon larger water masses and the ecosystems within them. New monitoring strategies to include these larger considerations need to be developed.

Present Activities

In FY 1978, the Federal Program dealing specifically with municipal sewage outfalls totaled $2,921,000. Only research focusing on sewage has been included in the total. Projects dealing with specific pollutants are included elsewhere in this report.

There are three principal projects dealing with comprehensive studies of the impact of sewage outfalls. These studies, all funded by EPA ($700,000 for FY 1978), deal with outfall problems in Hawaii, Southeast Florida, and Narragansett Bay, Rhode Island. All three studies examine the effect of sewage stress on their respective ecosystems and the response of the system to removal of the stress.

In FY 1978, almost 35 percent of the total was used by DOE, NRC, and EPA for studies concerned with the effects of chlorination of sewage and powerplant cooling water on marine receiving waters.

Related to the problems of chlorination is research dealing with the identification, fate, monitoring and effects of sewage originated pathogenic microorganisms (principally bacteria and viruses). In FY 1978, almost 25 percent ($695,000) of the sewage outfall research program was assigned to marine microbial pollution research.

One of the major scientific concerns is the impact of biostimulants (nutrients such as nitrogen, phosphorus, vitamins etc.) on the growth of phytoplankton and rooted aquatic vegetation. In addition to the three comprehensive studies mentioned above, the biostimulation problem is being addressed by EPA's Chesapeake Bay research program and NOAA's New York Bight study (MESA).

It is recognized (see above) that there is a strong need for monitoring ecosystem response around ocean outfalls. The Clean Water Act provides for waivers of the secondary treatment requirement for municipal treatment plants providing monitoring reveals no significant environmental degradation. While the FY 1978 program provides for very little monitoring of outfalls, present EPA/NOAA planning calls for extensive monitoring programs to be performed by the waiver applicants.

Within the municipal waste treatment technology research area the main concern is developing the engineering (i.e. degree and kind of treatment) parameters for sewage treatment plant design. This information is being developed by the ongoing ecological research and monitoring program. EPA's project in southeast Florida is examining marine ecosystem responses to different types of waste treatment.

The effects of specific pollutants present in sewage, such as persistent organic compounds and heavy metals, is covered in generic studies and comprehensive ecosystem studies. (Chesapeake Bay, New York Bight). Likewise sediment transport studies are underway in the two main study areas of New York and Chesapeake Bay. The problem of sediment quality is being addressed in research performed by EPA, NOAA, and Army COE.

Analysis

1. The current research program examining the effects of different kinds and degrees of treatment on receiving water biota is inadequate. Additional resources are needed to fund these studies to produce greater geographical representation.

2. The developing EPA/NOAA monitoring program should have quality assurance built into it to determine the statistical significance of any measured environmental alteration from normal background.

3. A data management system providing rapid and ready access to monitoring data should be developed for the national ocean outfall monitoring program.

c. Industrial Waste Disposal

Industrial wastes differ among industries, among industrial processes for manufacturing the same materials, and their composition even differs from time to time from the same outfall pipe. These differences, coupled with ecological and hydrological site differences, necessitate case-by-case consideration to administer the NPDES permit program for industrial wastes. For permitting purposes, guidelines for use within an industry or among industries using similar processes are useful, but cannot be counted upon if there is not a great deal of specific information on the kind, amount, transport, transformation, and effects of industrial waste in the ocean environment. The following needs relate to information identified as necessary for evaluating methods, costs, and benefits of industrial waste regulation.

Needs

Synthetic Organic Pollutants, Metals, and Inorganic Chemicals. Research and monitoring should be conducted to determine the sources, distribution, persistence, and bioaccumulation of synthetic organics, metals, and inorganic chemicals in the marine environment, including food web transfers and possible pathways to human exposure. Accidental chlorination products should also be included with materials deliberately discharged into salt-water environments.

Bioactive Industrial Compounds. Certain industrial waste discharges are rich in carbon, nitrogen, and phosphorous compounds which act as nutrients in the marine environment, much as do domestic sewage wastes. Some pharmaceutical manufacturing and food processing wastes also are high in nutrients derived from discarded living matter. The ecological and economic effects of these wastes in areas where they are significant, such as Puerto Rico, should be identified clearly and quantitatively, as should the costs and benefits of existing and development abatement technologies. Information derived in these research and development activities should be included in predictive risk assessment methods which are under concurrent development.

Monitoring of Industrially Polluted Environments. Both ecological and economic analysis of degree and speed of recovery of industrially polluted ocean environments should be conducted. Persistent and non-persistent synthetic materials should be considered separately.

Present Activities

In 1978, $4.3 million was used to carry out research on industrial wastes, primarily at ocean disposal sites in the Gulf of Mexico and off the coasts of New Jersey and Puerto Rico. The Navy used $506,000 of this to monitor and develop treatment systems for ordinance related wastes, and EPA directed some work to evaluate wastes from Caribbean rum distilleries and to develop standard methods for biological testing of industrial wastes. $2.2 million was used for research in other industrial dumpsite areas, primarily Deepwater Dumpsite 106, an industrial disposal site 90 miles east of Cape May, N.J. These studies focused on characterizing the chemical and biological nature of industrial wastes dumped at sea,

physical characterization of the dumpsites and laboratory studies on the effects of dumped wastes on several species of marine organisms.

EPA used $150,000 to monitor dumpsites; Coast Guard provided $250,000 for monitoring assistance and NASA used $300,000 to develop remote sensing capabilities for use in monitoring dumping activities.

No programs were reported for monitoring industrial wastes discharged at ocean outfalls.

Analysis

1. Research and monitoring of industrial dumpsites should continue, to the extent they are useful for assessing the capability of the oceans to assimilate waste through ocean dumping.

2. Overall emphasis should be shifted from ocean dumping to ocean outfalls and nonpoint sources. Ocean and estuarine areas impacted by industrial wastes should be monitored for degree and rate of recovery with respect to persistent pollutants on a site specific basis.

d. Dredged Material Dumping

Dredged materials by themselves are not necessarily pollutants. Their polluting qualities depend upon the extent to which they have been contaminated by other pollutants, and where they are redeposited in the marine environment. Even unpolluted dredged material can be a pollutant in areas where marine species are affected adversely by siltation, such as coral communities and oyster beds. Relatively little and only recent attention has been given to alternative uses of dredged materials, such as wetlands restoration, artificial island construction, and use as paving and building materials. Harbor dredging must continue for purposes of commerce and national security. Therefore, there is much technological

development and research required to prevent pollution from dredged materials and to use them for beneficial purposes.

Need

Ecological Impact. Studies describing the ecological impact of disposal of dredged materials in the coastal environment are needed.

Present Activities

The Corps of Engineers has completed a 5-year, $15M program dealing with the environmental aspects of dredging operations. This program included evaluation of the ecological impact of dumping in coastal areas.

In 1978, almost $1 million was spent by DOE, EPA, and NOAA on follow-on studies of the behavior of heavy metals associated with dredged materials and sediment transport in order to make recommendations for disposal site selection in specific regions.

A small amount ($145,000) was used by NOAA and DOA to evaluate stabilization techniques for dredged material disposal sites. This work should continue. If it is successful, it could minimize the need for additional dredging in the future.

Analysis

While some studies directly related to metals should continue, some of this effort should be redirected toward direct biological assessment in areas most likely to be subjected to dredging. Effects of sediment deposition as well as chemical alteration should be considered. Selected comprehensive studies examining dredge disposal areas before and after dumping should be carried out -- (such as the Chesapeake Bay).

Need

Prevention Technology. Means should be developed to minimize sediment resuspension and siltation in the water column. Dredge material emplacement

techniques should be developed to minimize resuspension of materials and to contain or isolate materials when necessary during disposal operations.

Present Activities

In 1978 more than $1.7 million (half of the total dredged materials program) was spent, primarily by the Army COE (with a small amount by Navy), for the development of new dredging equipment and techniques to minimize the need for dredging, as well as studies to understand the mechanism of sediment transport. Development programs directed toward minimizing the effects of dredging were not included.

Analysis

1. While development of techniques to minimize the need for dredging should continue, some of this effort should be directed toward development of dredging technology that minimizes the effects of dredging by reducing sediment resuspension.

2. Containment and/or isolation techniques should be developed for disposal of dredged materials under certain conditions. Criteria for use of such disposal procedures should also be developed.

Need

Disposal Site Monitoring. Ocean Dumping Regulations require monitoring of existing and new ocean disposal sites. Data from these monitoring programs should be used to determine the ecological effects of dredged materials disposal on both short- and long-term bases.

Present Activities

A total of $658,000 was spent in 1978 by the Army COE, NOAA, and EPA for studying the impacts of dredged material disposal. Sixty percent of this was used to evaluate bioassay techniques and develop procedures for making measurements. EPA carried out its study in the Great Lakes; NOAA

funded a small project in Newark Bay and the Army COE monitored open water disposal sites near Washington and Ohio and artificial wetlands constructed from dredged materials.

Analysis

1. These monitoring programs should be continued; a mechanism for information exchange and coordination between all separate activities should be established in order to pool experience and results.

e. Radioactive Waste Disposal

The United States has not conducted disposal of low-level radioactive wastes at sea since 1970. Prior to that time, however, such disposal was conducted in the Pacific at two sites near the coast of California and at two sites in the Atlantic near the Delaware coast. These sites provide areas for studying the long-term ecological impact of low-level radionuclides.

At-sea disposal of high level radioactive wastes by deep ocean emplacement is currently banned by international treaty and U.S. law. However, this disposal option should be evaluated for future use in any overall comparative study of nuclear waste disposal methods.

Need

Dumpsite Monitoring. Ecosystem recovery studies should be performed at phased-out dumpsites to determine time and degree of recovery and residual radionuclide abundance, distribution, and ecological effects.

Present Activities

In 1978, EPA and DOE spent $585,000 to monitor low-level radioactive waste disposal areas. EPA used the bulk of that to study the fate and behavior of waste containers at the four phased-out disposal sites near

the United States, a program that will almost double in size by 1980. DOE used a small amount ($40,000) to carry out a continuing program to study an active low-level radioactive waste disposal site in the Irish Sea for the purpose of gaining an understanding of the behavior of radionuclides in seawater.

Analysis

Current programs appear to be meeting identified needs and no changes are recommended at this time.

Need

High-Level Radioactive Wastes. Methods for emplacement and potential consequences of high level radioactive waste disposal in the oceans should be evaluated.

Present Activities

The DOE is carrying out a continuing program to investigate the possibility of high level radioactive waste disposal in submarine geological formations of the deep oceans. This program, funded at $300,000 in 1978 is expected to continue at the same level through 1980.

Analysis

Because of the importance of high level radioactive waste disposal, this project should continue at present or higher levels if greater effort would result in more timely information. Efforts should also be expanded to additional deep seabed disposal techniques such as encapsulation.

f. Ocean Incineration

Land disposal of toxic chemical wastes is becoming less acceptable to the public as previous disposal sites create severe, long-term pollution problems. Ocean incineration of such wastes may be a viable alternative; approximately 46,000 metric tons of toxic synthetic organics have been

incinerated at sea in recent years.

Need

Evaluation of Concept. Environmental and economic analyses of ocean incineration as an alternative to land-based disposal of hazardous materials should be evaluated.

Present Activities

EPA is evaluating five proposed ocean incineration sites. This evaluation examines the environmental considerations necessary for writing an Environmental Impact Statement. Approximately $300,000 was spent on this effort. A feasibility study is underway by EPA and the Coast Guard for evaluating the utility of converting an existing offshore platform for ocean incineration.

Analysis

Efforts in this area appear to be adequate.

3. MARINE ENERGY

a. Steam Electric Powerplants

Approximately two thirds of the operating nuclear and fossil-fueled electric generating plants in the United States are located in the coastal zone. Additional energy conversion and transmission facilities are scheduled to be operational in the coastal zone by the end of the century. Offshore floating powerplants are in the advanced stages of development.

Nuclear and conventional powerplants require large volumes of cooling water or engineered auxiliary cooling methods. This cooling water demand may elevate receiving water temperature and alter local biological community structure. Such alterations may actually be beneficial or may result in increased productivity and survivability of less desirable species at

the expense of more desirable ones. During the past decade considerable studies have been carried out on the temperature stresses related to powerplants, with little evidence of widespread damage to receiving-water ecosystems.

Regulatory concern has shifted from discharge temperature to the issue of adverse affects of intake entrainment on small organisms passing through the plant in its cooling water and from size of the discharge mixing zone to actual effects of effluent on the balance of species in the surrounding ecological community.

All powerplant cooling water discharges contain trace amounts of metals dissolved from heat exchangers surfaces as well as small amounts of water treatment chemicals and biocides used to maintain efficient plant operation. Trace amounts of radionuclides may be present in discharges from nuclear powerplants.

Need

Ecological Impact of Cooling Water. An unresolved issue in several steam electric plant adjudicatory proceedings has been the extent to which cooling water damage to the young of commercially, recreationally, and ecologically important species affects the abundance and distribution of the adults. The impact of low-level chronic thermal stress in combination with effluent chemical pollutants from coastal and offshore powerplants must be evaluated.

Present Activities

In 1978 more than $2 million was spent on research related to assessment of the impacts of cooling water discharge on marine ecosystems. Studies were carried out by NRC, DOE, EPA, NOAA, and FWS. Approximately

half of the $2 million was directed toward identification of chlorination products and their behavior; a small amount was used to study the direct effects of chlorination products on fish and plankton communities.

27% ($540,000) was used to study the effects of elevated temperatures on shallow water organisms including fish, benthos, plankton and fouling communities. The Davis Besse powerplant on Lake Erie received special attention, while other studies were less site specific. Several studies considered synergistic effects of temperature and pollutants.

24% ($480,000) was used to determine the behavior and effects of copper and radionuclides that may be discharged from cooling water systems and to measure the distribution of radionuclides in sediments of the Columbia River outfall where a nuclear powerplant upstream had caused concern in the past.

Analysis

1. Future studies on powerplant and industrial effluents should be directed toward determining the synergistic effects of chlorination byproducts and elevated temperature.

2. A great deal of research is currently underway or has been carried out in the past on the behavior and effects of metals in the marine environment. At attempt should be made to use information from these studies rather than to initiate new research specifically applicable to cooling water effluents. Emphasis should be shifted to monitoring metal and radionuclide levels in cooling water discharges and to characterizing their distributions in shallow water environments on a site specific basis.

Need

Transport of Pollutants from Powerplants. The physical, chemical, and geological conditions that influence pollutant transport and behavior in

the vicinity of coastal and offshore powerplants must be characterized on a site-specific basis prior to powerplant siting.

Present Activities

In 1978, $1.9 million was spent by NRC and DOE on studies directly related to defining transport regimes and developing predictive models for pollutants from powerplants. While most of this was aimed at nearshore areas for plants located in the coastal region, some effort was directed by DOE toward transport regimes on the continental shelf, presumably in anticipation of offshore facilities.

Analysis

1. Support of basic modelling technique development should continue. However, emphasis should be placed on development of generalized techniques that can be modified for specific site conditions.

Need

Geological Hazards. Geological hazards in the vicinity of operating and proposed coastal nuclear powerplants must be assessed in order to estimate the risk of large-scale radionuclide release as a result of seismic activity.

Present Activities

Although no programs in the inventory can be identified as directly responsive in this area, considerable work on geological hazards is carried out by USGS. Prior to approval, each site is studied by the applicant. The NRC reviews and audits these site-specific studies.

Analysis

Need

Habitat Modification Resulting from Powerplant Construction. Alterations to sediment transport, current patterns and ecosystem structure resulting from construction of offshore powerplants must be evaluated as well as the electrical power transmission systems with their accompanying electric fields.

Present Activities

Although there are no existing offshore powerplants, their construction appears likely within the next 5 years. Federal programs to assess potential impact of offshore powerplants have focused on preparation of the EIS for floating nuclear powerplant manufacturing licenses.

Analysis

Areas where offshore powerplants are most likely to be constructed within the next 5 years should be identified. Appropriate studies to define potential impacts should be coordinated by DOE in these areas using existing NOAA and EPA programs where possible.

Need

Entrainment and Impingement. The young of commercially and ecologically important marine species need to be kept from passing through cooling water systems. When siting in spawning and nursery areas cannot be avoided due to economic, jurisdictional and engineering reasons, means to minimize their exposure to the generating plant need to be developed. Shallow water sites and shorelines are the greatest technological challenge to protect. Offstream cooling and diffusion technologies need to be made more efficient and less expensive to build and operate.

Present Activities

A total of $210,000 was spent in 1978 by NRC and FWS for determining the impact on ecosystems of entrainment and impingement from powerplant cooling water systems. Half of this was directed specifically at the effects on striped bass and white perch in the Hudson River, the other half was used for obtaining information for design criteria to minimize impact and for predictive models for fish stock assessments.

Analysis

1. Generalized research to provide predictive models and information upon which to base system design for minimum impacts should be continued.

2. Studies with limited application should be reevaluated and phased out as soon as information to determine probable impact is adequate.

b. Ocean Thermal Energy Conversion (OTEC)

Marine thermal gradient systems such as OTEC would utilize the temperature difference between warm surface waters and cold deep ocean waters as a source of energy for electrical power generation.

Small-scale pilot programs to assess OTEC feasibility are being conducted off the coast of Hawaii. Engineering designs for full-scale OTEC plants indicate that the primary cause of pollution from them will be the large cooling water flow necessary, as much as 10 times that required for an equivalent capacity conventional powerplant. While pollutant concentration in OTEC plant discharges may be equivalent to that of conventional discharges, that is 0.1 parts per million of chlorine as a biocide, the increased flow may be an environmental problem. Large-scale upwelling of nutrient-rich, cold bottom waters may also significantly alter the marine environment. Such problems are not expected to be of concern for at least 10 years, since commercial-scale OTEC will take that long to complete development.

Need

Water Movement Effects. OTEC systems will move 10 times more seawater per unit of electricity generated than conventional electrical generating systems. Cold, nutrient-rich waters from below the thermocline will be mixed with warm, plankton-rich waters above it. Effects of this water movement on bottom dwelling water column animals (mostly fishes), and surface dwelling planktonic and larger species need to be examined. Entrainment, impingement, entrapment, temperature and pressure effects, and nutrient enrichment of surface waters require evaluation for significance and duration.

OTEC Chemical Discharge Effects. Risks need to be assessed for all possible hazardous chemical releases, including gases released in open cycle OTEC systems and chemicals that may be produced when offshore chemical production plants are integreated with OTEC facilities. Normally produced sea salt scale and accidental releases of amonia, chlorine, hydrogen, and aluminum smelting residues need to be evaluated as potential ocean pollution hazards.

Electrical Transmission Problems in the Ocean. OTEC systems may require underwater transmission of electricity to onshore power grids. The pollution and ecological disruption potential of these underwater or buried sea floor transmission devices needs to be evaluated, as do hazards of accidently severed transmission cables.

Present Activities

In 1978, DOE spent $876,000 on OTEC-related research. Almost 90 percent of this was used for preliminary and baseline studies including satellite measurements for OTEC siting and eventual evaluation of ecological signifi-

cance. Ten percent was used to evaluate effects of chemical releases from OTEC plants and potential impact of impingement and entrainment losses. This work is planned to continue at significantly great levels for the next few years.

The Federal program did not address the environmental consequences of electrical power transmission in the ocean.

Analysis

1. Baseline studies for potential OTEC facility siting should continue. However, whenever possible, they should be carried out in conjunction with similar studies as required by other programs such as BLM oil and gas leasing and deep seabed mining.

2. Current OTEC pilot operations should be used for gathering information on the effects of large water-mass movements. The pilot facility should be used as a field station for necessary ecological impact and assessment studies to the extent possible.

3. To the extent that electrical power from OTEC facilities will be transmitted to shore stations within the next 5 years, research on the effects of the electrical field surrounding the cable and environmental disruption caused by the cable as it differs from ordinary underwater pipeline construction and disruption, should be carried out.

c. Other Energy Technologies

A number of alternative ocean energy conversion technologies are being evaluated. Most are at the conceptual stage. Kinetic energy systems which would harness the power of wind, waves, tides and currents are being considered; marine biomass (kelp) cultivation as a fuel source is being explored; pilot scale projects dealing with extraction of coastal geothermal energy are underway; and the possibility of satellite power systems which

would capture solar radiation in space and beam energy to massive receiving antennae in the ocean has been proposed. These systems will not be significant energy sources in the near term; however, evaluation of possible polluting consequences to the marine environment should be part of early development work to ensure that informed decisions can be made regarding future development areas.

Needs

Geothermal Energy Systems. Pollution potential of coastal geothermal energy systems including assessment of the polluting potential of produced brine, thermal discharges and trace contaminants should be evaluated.

Biomass Fueled Systems. The ecological consequences of artificial upwelling of large volumes of nutrient-rich bottom waters for commercial-scale kelp farming should be evaluated.

Kinetic Energy Systems. The biological and climatological effects of large-scale marine kinetic energy systems which extract wind, tidal, current and wave energy should be evaluated.

Satellite Power Systems. The ecological and climatological effects of an ocean-located satellite power system receiving antennae should be evaluated.

Present Activities

The current Federal program does not directly address the environmental consequences of these experimental energy systems, although some results from OTEC research on the effects of artificial upwelling may have application to biomass-fueled systems.

Analysis

1. Studies to determine potential environmental problems should be carried out as an integral part of development programs for all new energy

generating systems so that problems can be defined and taken into consideration in feasibility and economic assessments.

4. MARINE MINERAL RESOURCES

a. Oil and Gas Development

It is increasingly difficult to extract oil from onshore reservoirs in the United States. This is also true of offshore oil in shallow waters of the Gulf of Mexico. More difficult offshore oil recovery in Alaska, the northeastern Atlantic, and California coast are centers of active industrial interest. Whereas Kodiak and southern California oil fields are proven, Atlantic oil formations are just opening up to exploration. In Alaska, New York, and the New England States, the balance between oil supplies, fisheries, and coastal recreation is a matter of heated controversy and some litigation. If we are to preserve our renewable resources as we extract oil and gas from the outer continental shelf; research, development, and monitoring are needed to provide a better foundation for rational decisions on minimizing risks and protecting other resources.

Need

Discharges From Drilling and Production Operations. Normal operational discharges from offshore exploratory and production rigs consist largely of drilling muds, drill cuttings, and formation water containing suspended oil and brine. Drilling muds vary in chemical composition to fit differing needs of the drilling process. Their range of chemical components should be examined. The physical transport processes and ecological effects of drilling muds and cuttings must be determined, particularly in sensitive marine areas such as coral reefs, fish and shellfish spawning and nursery areas, and for bottom communities in the vicinity of drilling platforms.

Based on this information, protocols should be established for composition and disposal of discharges of concern. A variety of overboard discharge methods for operational drilling platform wastes should be investigated. Although discharges from production wells are sampled periodically to keep oil content below 50 parts per million, the effect of this chronic discharge on marine organisms is a source of concern.

Present Activities

In 1978 EPA spent $348,000 to study the effects of drilling muds and cuttings on marine organisms. Laboratory and field tests were carried out primarily on benthic food web organisms and communities. Considerable work has been carried on in this area by the industry in past years; however, there is little agreement on its adequacy.

Analysis

1. Past drilling mud studies should be thoroughly assessed before additional studies are funded. Special emphasis should be given to effects studies under realistic exposure conditions in the field.

2. Sensitive marine areas should be identified and tested prior to drilling platform sitings so that appropriate discharge requirements can be set.

3. Alternative discharge methods should be evaluated in selected test areas so that reconditioning or removal of drilling muds can be recommended for sensitive areas if necessary.

4. Results of other studies on the effects of long-term (20-year), low-level ecosystem exposure to oil should be evaluated for applicability to production platform discharges.

Need

Geological Hazards. Geological hazards that affect the siting of platforms and other offshore structures must be determined. Sediment instability and seismicity are especially important. Special problems associated with development in the Arctic, such as the effects of ice gouging and permafrost require additional study.

Present Activities

In 1978, the Department of the Interior spent more than $4.6 million on geological studies related to OCS activities. $4.3 million was used by BLM for region-specific assessments of geological hazards and sediment mobility. 61 percent of the effort was directed to Atlantic coast lease areas, 20 percent to Alaska, 11 percent to Pacific coast areas, and the remaining 4 percent to the Gulf of Mexico. USGS spent $289,000 primarily for region-nonspecific studies to understand sediment movement as a means to predict seafloor instability.

Analysis

1. Emphasis on geologic studies should be placed on development of risk and damage assessment criteria.

Need

Biochemical Effects of Oil. The effects of spilled oil on marine ecosystems and their ability to recover from spilled oil should be determined experimentally and, as the opportunity arises, in the field. Highly productive, shallow water fisheries such as Georges Bank are particularly susceptible to damage by effluents and spills from production platforms. The effects of chronic low-level discharges of oil must be evaluated in order to predict impact on fisheries.

Arctic conditions foster special needs; the arctic is not well understood, and variations in structure and function need to be measured as baseline information.

An understanding of how to detect the presence of spilled oil under ice, how it disperses, how it accumulates in leads and brine ponds, and its effects on migrating marine mammals and birds must be obtained.

Present Activities

In 1979 almost $ 4.8 million was spent to study the behavior and effects of oil. 42 percent of this was directed to Alaska and the Arctic. The greatest amount, 80%, more than $ 3.8 million was funded by BLM; EPA spent $2.2 million, or almost 47 percent. Other smaller programs were carried out by NOAA, DOE, USGS, FWS, AND NIEHS.

$6 million was spent by BLM for physical oceanographic studies including transport processes and the behavior or ice and permafrost in Alaska. 37 percent of this work was carried out in Alaska. The remainder was directed at the south Atlantic coast and Georges Bank area.

A small amount, $430,000, was used to study the behavior of oil, particularly its association with bottom sediments, while $3.3 million was used to measure existing natural and man-induced distributions of oil and trace elements in Alaska and the Gulf of Mexico.

More than $4 million was spent, primarily by EPA and BLM, to study the effects of oil on fish, birds, marine mammals, and shellfish. NIEHS carried out studies at a more basic level on carcinogenic responses and effects on organism defense mechanisms. NOAA funded studies on the direct effects of oil on fish and shellfish.

BLM funded a small project, $561,000, to study oil-spill recovery rates in the middle-Atlantic.

Analysis

1. Over 50 percent of the oil and gas effort is directed at Alaska. This emphasis should be reevaluated.

2. Special attention is being given to study of arctic ice conditions and the present effort appears to be appropriate.

3. Emphasis should be shifted from short-term to long-term studies on the synergistic effects of oil and other pollutants on marine ecosystems.

Need

Biological Characterization for the OCS Leasing Process. In order to assess the impact of OCS oil and gas development, important living marine resources and their habitats must be identified so that appropriate protective measures can be developed.

Present Activities

In 1978 more than $12 million was used for ecosystem characterization of OCS lease areas, primarily off Alaska, off the middle and north Atlantic coasts, and in the Flower Garden Banks area of the Gulf of Mexico. $1.2 million was used by EPA for planning overall assessment studies and assessment of the Buccaneer Oil Field in the Gulf of Mexico to evaluate the ecological consequences in an ongoing oil field.

Analysis

Emphasis should be placed on identification of sensitive marine areas prior to leasing and assessment of impact in existing high production areas.

Need

Transshipment of Oil and Gas. Disruption of biological habitats by pipeline construction and placement across beaches and wetlands must be

evaluated. Existing pipelines should be monitored to determine actual impacts.

Present Activities

EPA spent $67,000 in 1978 on a study to consolidate and evaluate existing information on submarine pipelines and their environmental consequences. BLM plans a similar study in the Gulf of Mexico.

Analysis

Based on the results of the EPA study, additional consideration should be given to studies of pipeline construction taking advantage of existing pipeline monitoring in sensitive areas.

Need

Development of Preventive and Safety Technology. Offshore platforms are "point sources" of potential spills. They are subject to the harsh marine environment and must be routinely inspected for potential failures. Techniques and equipment, including unmanned remote controlled equipment, to improve nondestructive testing and inspection of platforms and pipelines must be developed. In addition, equipment to promptly detect smaller discharges from pipelines must also be developed. There is a need to develop the capability for independent evaluation of drilling technology. There may be a special need in the arctic to be able to stop blowouts under ice. Rapid movement of the ice pack may necessitate caping blowouts under ice. Methodology for pollution control under ice should be developed. Risk assessment of the probability and severity of such occurrences should be developed.

Present Activities

USGS spent $751,000 to develop equipment and methods for preventing drilling accidents and inspecting offshore structures. Approximately

30 percent of that was used to develop sensors for hydrocarbon leak detection, and blowout prevention systems for deepwater drilling. The remainder was used for offshore platform inspection-related development, including methods to detect and predict structural failure, underwater inspection tools, and improved safety for launching and retrieving divers and submersibles in heavy seas.

Analysis

Greater emphasis is suggested for risk analysis and developlment of inspection and prevention systems for Arctic use.

Need

Oil Spill Damage Assessment. The 1978 Outer Continental Shelf Lands Act Amendments establish an oil-spill compensation fund which authorizes reimbursement for losses to national resources. Questions that need to be answered in order to administer this fund are: what was damaged? how was it damaged? and how much was it damaged? We need to be able to convert losses of natural resources into equitable monetary values. A major research effort is recommended to develop this method.

Improved techniques are needed for presenting the results of oil spill trajectory analyses in easily understandable form so that important differences between alternatives can be highlighted.

Present Activities

With the exception of a few BLM projects evaluating cultural resources (sunken vessels of historic interest) in the Atlantic OCS areas which amounted to $400,000 in 1978, there was no Federal effort to relate natural resource losses to monetary values.

Analysis

1. Methods for evaluating natural resource losses in terms of dollars

should be developed for use in oil-spill liability compensation as well as cost/benefit analysis for ocean-use decisions where pollution risks exist.

b. Deep Seabed Mining

Manganese nodules and crusts, the focus of the activity, are found throughout the world in fresh and salt water. Commercially exploitable deposits, however, are limited to the deep seabed in international waters of the eastern equatorial Pacific Ocean at depths of 4,000 to 5,000 meters. Although commercial scale mining is not likely to take place before the mid-1980s, exploratory recovery and small-scale prototype mining are currently being carried out. The chronic environmental consequences of removing large quantities of nodules and associated sediments from the deep seabed must be better understood.

Needs

Surface and Water Column Effects. Present nodule recovery technology requires large volumes of sea-floor sediment to be brought to the surface along with recovered nodules. In order to determine the effect of this sediment on the ocean surface, the following studies should be carried out.

Characterize the particle size range of particulate discharges, their chemical composition, and their physical integrity.

Determine the distribution and fate of sediments discharged at the surface.

Examine the extent to which surface discharges stimulate or inhibit plankton populations and whether or not dissolved or particulate discharged material enters the marine food web.

Consider the necessity and practicality of discharge below the thermocline.

Bottom Effects. In essence, deep-sea mineral extraction stripmines the surface of the sea floor and is by necessity highly disruptive. It is not known to what degree this disruption will affect deep-sea life. Further, the extent to which deep-sea living creatures are important to man should be determined. Toward these ends, the following research is recommended:

Species disturbed by the dredge should be inventoried.

Effect of the mining process on deep-sea life should be described (e.g., masceration, siltation of habitats or food organisms, attraction and destruction, avoidance, etc.)

The prospect of regrowing mineral deposits should be investigated.

Processing and Production. Nodule processing is likely to be carried out at land-based facilities in the near future, but shipboard processing may become feasible at some time. The chemical and physical properties of processing wastes disposed of at sea should be determined, and the effects of alternative disposal and processing schemes should be evaluated.

Present Activities

In 1978, NOAA spent $990,000 for studies related to the environmental consequences of the first successful test of a demonstration scale deep seabed mining system. Additional studies in previous years concentrated on establishing baselines and defining natural systems in potential mining areas. Slightly more than half of the total was used to study surface and water-column effects and characteristics of the sediment

plume generated by the mining test operation; the remainder went to investigating the impact of the mining dredge on benthic organisms and defining the magnitude of the benthic plume created during the test. This program is scheduled to be phased out by 1980, as data analysis and synthesis are completed.

Analysis

1. It appears that some additional work could be done in order to completely define the overall environmental consequences of deep seabed mining. However, further studies cannot be cost effectively carried out without prototype mining operations by the deep seabed mining industry. Since additional prototype mining is not planned for the near future, further environmental assessment work should be planned and phased in when prototype mining is resumed. This work should be continued for a sufficient time to define long-term impacts on the deep seabed.

2. Studies to define the chemical and physical properties of nodule processing wastes should be undertaken in cooperation with industry. To the extent that such wastes may be disposed of at sea, research leading to criteria for disposal methods should be undertaken.

c. Sand, Gravel, and Shell Mining

Sand, gravel, and shell mining occur primarily on the shallow continental shelf, in areas filled with ecologically and economically important marine life. It is a use which competes with habitat stability, sport fishing, commercial fin- and shell-fishing, navigation and aesthetics in the coastal zone. Although it does not introduce foreign matter and chemicals into the sea, its primary effects local areas by extreme disruption of the shallow sea floor. ???

Needs

Technology Development. Mining technology that is less disruptive to the water column and surrounding seafloor should be developed. Silt containment and pattern mining to match hydrologic features of the area should be considered.

Long-Term Hazards. Determine the long-term effects, on benthic organisms as well as fisheries, of substrate alteration caused by fine sedimentary particles that result from mining operations and eventually blanket the sea floor over large areas. Determine the effects, on both fisheries and coastal erosion, of excavations in the sea floor caused by the removal of sand and gravel.

Sediment Hazards. Short-term effects on the metabolism and survival of organisms confronted with high concentrations of suspended fine sediments in the vicinity of mining activities should be determined.

Present Activities

The current Federal program contains no projects directly related to the pollution consequences of sand, gravel, and shell mining; however, planning for a 3-year environmental study to begin in 1979 in the Virgin Islands was completed.

Analysis

1. Research and technologies related to dredging operations should be assessed for their applicability to sand, gravel, and shell mining, and transferred where possible.

2. Additional research should be undertaken where necessary on a site-specific basis to resolve unanswered questions on local ecosystem impacts.

3. Considerable progress in sand, gravel, and shell mining has taken place in Japan. These industries should be canvassed for technologies that may be of benefit for reducing environmental concerns in the United States.

d. Brine-Producing Activities

Natural and manmade brines are heavier than seawater and tend to creep along the bottom in streams until physical mixing disperses them. In the few places where this is a problem, effects can be locally devastating to exposed marine life. Current brine-producing activities are desalinization for production of freshwater and the storage of oil in underground or undersea salt domes.

Need

Brine Disposal. The dispersion of brine and effects of brine disposal on marine organisms and ecosystems in affected areas should be studied.

Present Activities

In 1978 the DOE spent $2.5 million to determine the effects of brine disposal from salt dome oil storage facilities in the Gulf of Mexico. This effort is planned to expand considerably over the next year.

Analysis

Activities in this area appear to be more than adequate for the limited area of impact. Considering the relative significance of these brine disposal activities, the program should be emphasized less in the overall Federal Plan.

5. MARINE TRANSPORTATION

The primary source of ocean pollution from marine transportation results from vessels carrying oil and hazardous chemicals as cargo. The major portion of this pollution comes from operational discharges. Efforts to reduce operational discharges escalated as a result of the President's message of 17 March 1977 concerning the reduction of oil pollution of the oceans. The President's initiatives resulted in international agreements under the aegis of the Inter-Governmental Maritime Consultative Organization (IMCO). Parallel regulatory actions were also undertaken within the United States. These actions are expected to considerably reduce the amount of oil introduced into the oceans as a result of operational practices.

Many agreements were also reached through IMCO which will reduce the potential for accidental discharge of polluting substances from vessels. Again, a wide range of regulatory actions have been initiated in the United States to implement these agreements. These efforts call for improved navigation of vessels, installation of inert gas systems, strategically located segregated ballast and improvements in the qualifications of shipboard personnel. A vigorous foreign vessel boarding program is also being conducted by the Coast Guard to detect and eliminate substandard vessels. While these efforts will have an impact on the amount of pollution entering the sea, accidental discharges from vessels will continue to occur. The achievement of a zero accident rate in a potentially hostile environment such as the sea is unrealistic. Nevertheless, additional improvements in the status quo are possible.

Need

Transport of Hazardous Materials. Better information is needed on general traffic routes for hazardous chemicals, trends in quantities transported, and the hazards of new chemical products.

Present Activities.

The U.S. Coast Guard identifies cargo of particular hazards and establishes specific requirements for their traffic control and transfer operations. Although this applies to a limited number of products, Coast Guard Captains of the Port are aware of and regulate all hazardous cargo movements within their area of responsibility. Data on product traffic and quantities are available from various sources but are not in a useful form. Information on hazards posed by a wide range of chemicals is available in several data storage systems, including the USCG's "Chemical Hazards Response Information System" (CHRIS), EPA's "Oil and Hazardous Materials Technical Assistance Data System" (OHM-TADS), and the "Chemical Transportation Emergency Center (CHEMTREC), operated by the Manufacturing Chemists Association. A description of the hazards associated with new chemicals to be shipped in bulk on U.S. waters must be submitted to the Coast Guard before the cargo can be transported. The number of chemicals contained in each of the USCG's and EPA's systems approximates 1,000; however, the data points for the hazards of each are not complete. CHEMTREC possesses a more complete information file but much of the data is maintained as proprietary.

Analysis

1. Obtain better information on general traffic routes for hazardous chemicals and trends in quantities.

2. Maintain existing levels of effort to ascertain the hazards associated

with transported cargoes.

3. Evaluate the hazards of new chemicals and products under the Toxic Substances Control Act.

Need

Redundant Equipment on Vessels. Additional research on the relative reliability among various safety systems is needed.

Present Activities

Considerable technical work and analysis has been performed to determine the extent to which placing redundant equipment on vessels will reduce the potential for pollution incidents. This topic was most recently addressed at the International Conference on Tanker Safety and Pollution Prevention, and is being reviewed within the Coast Guard's commercial vessel safety program.

Analysis

1. Because there is disagreement on the extent to which redundant equipment should be required, despite the recent efforts at the Intergovernmental Maritime Consultative Organization, a study effort on the relative reliability of safety systems is needed.

Need

Vessel Design Research. Additional work is needed to determine optimum location of strategically placed segregated ballast.

Present Activities

Work has been accomplished through the Intergovernmental Maritime Consultative Organization, Society of Naval Architects and Marine Engineers, and Ships Structure Committee.

Analysis

1. There is still disagreement on the way to optimize the location of strategically placed ballast. Additional work in this area

would be useful to settle the controversy.

Need

Emergency Cargo Transfer Systems. The utility of requiring emergency cargo transfer systems on tank vessels should be determined.

Present Activities

The question has been investigated on several occasions within various fora, including the Intergovernmental Maritime Consultative Organization. Efforts to date have indicated that the systems would be of limited value.

Analysis

There is some disagreement concerning the usefulness of such a system. An additional study effort which estimates the amount of pollution which would potentially be eliminated if such a system were installed on tankers, and the estimated cost of placing and maintaining such a system on these vessels would serve to resolve the issue.

Need

Personnel Error. Analysis of past pollution incidents should be undertaken to determine how to avoid placing operating personnel in situations that lead to human error.

Present Activities

Efforts to date have been primarily directed at determining the training that an individual must have to function satisfactorily in a position, and the level of manning that is needed to safely run a ship. The latest work in this area was performed as a result of the Presidential Initiatives of 1977 to Reduce Oil Pollution of the Ocean. The efforts culminated in the 1978 Conference on Training and Certification, sponsored by IMCO. The Port and Tanker Safety Act of 1978 also addresses this subject in detail. The unique dangers associated with maneuvering longer

and larger vessels have been recognized and operational tests have been conducted to determine the maneuvering capabilities of these vessels. Simulators have been built to permit operators to experience the problems of vessel maneuvering in a "safe environment." Recent studies indicate human error is a major factor in 80 to 85% of all pollluting incidents. Efforts to define what human error is avoidable by changing the work environment are ongoing. The work is extremely complex and is only in the embryonic stage.

Analysis

Work to identify how to avoid placing the human in situations where there is a high probability of human error should be the focal point for the immediate future.

Need

Pollution Threat From Lightering. Evaluate the threat of pollution posed by lightering operations off the coasts of the United States. The results will allow prudent drafting of regulations, and will support their enforcement.

Present Activities

Related analyses have been performed in conjunction with the development of Environmental Impact Statements for proposed deepwater ports.

Analysis

1. Data should be collected and analyzed to evaluate the pollution threat from these operations.

Needs

Oily Water Discharge Monitors for Vessels. International agreements will soon limit operational oil discharges within 50 miles of land. The Coast Guard will enforce this agreement. The most efficient enforcement mechanism would require vessels to install an oily water monitor that

will indicate and record for Coast Guard review when ballast or bilge water discharged and whether the oil content exceeded regulatory limits. Development of such a device is needed for installation on vessels.

Present Activities

Various manufacturers indicate that reliable systems are within the state of the art. The international shipping community disagrees.

Analysis

1. An engineering evaluation program is necessary to determine if reliable state of the art equipment exists.

2. An appropriate development program should be undertaken if the demonstration program does not produce an acceptable candidate.

Needs

Hazards of Nuclear Propulsion Vessels. There have been many studies performed to define the risks to the marine environment posed by nuclear propulsion aboard vessels, but their results have caused much disagreement. As fossil fuel supplies diminish large numbers of nuclear propelled vessels may be proposed as an alternative. Risks of ocean pollution effects from this change should be analyzed.

Present Activities

Military nuclear vessels have been built over the past 20 years. Many radiation safety studies, including the monitoring of base operational areas, have been conducted on a routine basis. No private interest in the construction of nuclear vessels has been shown recently.

Analysis

1. A survey of past work in this area should be performed. A program to fill identified information gaps should then be developed.

6. OTHER SOURCES OF OCEAN POLLUTION

Recreation

Recreational activities are probably a relatively minor source of pollution. Most forms of recreation-related pollution are related to marine waste disposal and marine transportation.

Needs

Litter Generated by Recreation. Although 103,000 tons of litter per year is estimated to be generated by marine recreation, this quantity is miniscule compared to the solid waste problem of even a small municipality. We do not, however, know much about its effects or the loss of aesthetic value caused by this waste in coastal waters. There is a need to determine the amounts and kinds of pollution resulting from marine recreation, their importance, and what, if anything, need be done.

Habitat Disruption. Recreational activities that disrupt habitats are a source of concern. Although the ecological impacts are not quantified, there is great public interest in the problem. Objective assessments of ecosystem impact, extent of damage, costs, and benefits are needed to support management of recreational resources at the State and Federal regulatory level.

Marina Design. Criteria for marina design should be developed so that flushing characteristics can be maximized and alteration of circulation patterns can be minimized in the local environment.

Marine Sanitation Devices for Recreational Craft. Devices to hold and treat domestic wastes on small recreational boats must meet minimum regulatory requirements set mandated by the Clean Water Act. The need for

these regulations has been questioned by the boating industry and boaters. Studies should be performed to determine whether chlorinated wastes are more or less harmful than untreated wastes and whether wastes can be pumped directly overboard from small craft into coastal and estuarine waters.

Present Activities

In 1978 EPA funded one $12,000 study on design of small-boat basins.

Analysis

1. Marina design studies to improve design criteria for small-boat basins should be continued.

2. Studies to determine the effects of chlorinated wastes from small craft on recreational waters should be carried out with the objective of determining when and where, if at all, wastes can be discharged directly into coastal estuarine waters.

3. Assessment of aesthetic and ecological damage caused by recreational use of coastal and underwater Federal lands should be carried out with the objective of establishing regulatory and public awareness programs. State and local governments should be encouraged to carry out similar programs for areas under their jurisdiction.

b. Living Resources

Industries that farm or process living marine resources may pollute the ocean.

Needs

Fish and Shellfish Processing Wastes. The kinds of pollutant problems caused by processing wastes should be documented and evaluated for ecological significance. The extent to which these wastes are located or treatment problems should be examined.

Hatchery and Aquaculture Wastes. The polluting consequences of hatchery and aquaculture wastes should be evaluated to determine what, if any, waste treatment is necessary.

Disease Transmission. Fisheries processing wastes may serve as a vehicle for transmission of human and fish pathogens. The potential risk of such transmission should be evaluated.

Present Activities

There were no Federal activities reported in 1978 that directly addressed the pollution problems expressed above.

Analysis

1. Studies should be undertaken in cooperation with the fishing and mariculture industries to identify and quantify pollutants in wastes discharged from their operations on a site or facility specific basis. Likely pollution consequences should be estimated using related studies in other fields. Regulations, if necessary, should be developed using such information.

2. Fisheries processing wastes should be evaluated for their human and fish disease transmission potential.

7. ACCIDENTAL DISCHARGES

In spite of efforts to limit accidental introduction of pollutants to the marine environment, such incidents will continue to occur. However, the effects of these discharges can be minimized. Risks can be assessed by predicting the probability of accidents and the potential magnitude of resulting damage to natural resources. These risk analyses provide the information needed to make decisions that will minimize potential environmental harm and to develop comprehensive approaches for responding to polluting incidents.

a. Risk Analysis

Effective utilization, conservation, and development of ocean and coastal resources requires a thorough assessment of the probability of pollutants entering the ocean from activities such as oil and gas development, industrial complexes, coastal powerplant siting, and transportation. Techniques should also be developed for assessing the value of natural resources lost due to polluting incidents. Such information is necessary for assessing liability and, in combination with information on probability of polluting incidents, for making informed, equitable decisions on facility siting and OCS oil and gas development activities which may conflict with other beneficial uses.

Need

Risk Analysis Techniques. Risk analysis techniques which include evaluation of social and economic factors and potential for human error must be developed for use in decisionmaking relative to marine pollution.

Present Activities

Environmental Impact Statements are required for any project involving Federal funding, or for which a Federal permit is needed. The state of

the art for evaluating risks involved in handling and transporting oil is good and has been evaluated in several study efforts. Data on past hazardous chemical incidents is lacking. Risk assessment in this area is therefore weak. Little has been accomplished in comparing the social and economic ramifications of discharges with those of limiting a particular activity. This is primarily due to the lack of knowledge concerning other than the acute effects of pollutants. Studies to reduce the potential for human error are not routinely conducted. Post accident analyses of major accidents are usually conducted by regulatory agencies and often result in new requirements to eliminate identified causes.

Analysis

1. Levels of marine activity that might result in unacceptable levels of pollution should be defined. Current legislation should then be altered to require the submission of an environmental impact statement by all sponsors of activities that exceed identified levels.

2. Appropriate regulatory agencies should intensify their efforts to identify and eliminate operating conditions with potential for encouraging human error.

Need

Loss Evaluation Methods. Standard methods for evaluating losses of natural resources from polluting incidents and for converting these losses to monetary values for liability determinations are needed.

Present Activities

Work has been accomplished in this area in a number of forms. Assessment schemes for accomplishing this exist in the States of Virginia, California, Washington, and Florida. None of these is as extensive as is considered necessary for national standardization.

Analysis

1. A review of existing and proposed schemes should be undertaken.

2. A standard method for loss evaluation should be developed to administer the fund established by the 1978 Outer Continental Shelf Lands Act Amendments. A loss evaluation methodology will also be needed to administer superfund legislation.

Need

Spilled Pollutant Movement Models. Mathematical models have been developed to predict pathways that oil and/or hazardous chemicals can follow when released into the marine environment. Improved models which consider mixing and toxicity effects are needed to perform risk analyses and to assist personnel involved in planning cleanup and mitigation strategies during response actions, as well as to assist researchers in predicting distribution of pollutants which will result from planned waste disposal discharges.

Present Activities

A number of two-dimensional oil-spill trajectory models exist. Development of three-dimensional models is ongoing. A Hazard Assessment Computer System (HACS) is operated by the Coast Guard to describe the behavior of chemicals spilled on water and to calculate the hazards presented by these spills. Graphic output displays to show the relationship between spill concentration, vapor dispersion, evaporation rate, venting and sinking and flame size and location as a function of time have been developed for a variety of chemicals. This permits locations, flame fronts, explosive and toxic areas to be estimated. Vulnerability models are now being developed to predict possible loss of life and property damage at specific geographical locations for various sized accidents. Tests to verify the HACS method are underway.

Analysis

1. Development of three-dimensional oil-slick trajectory models and vulnerability models should continue.

2. Testing efforts to verify the HACS model should be intensified so that improvements can be made. This latter effort should be given the highest of priorities due to its potential for saving lives, as well as limiting environmental damage. Better coordination in the development of oil trajectory models also appears to be needed.

b. Spill Cleanup and Response

Oil and hazardous material spills range from catastrophic releases to incidents of minor impact on the oceans. The capability to mount a rapid and effective response to polluting incidents is vital to minimizing their effects. Although much effort has been expended by the Federal government in this area, considerable work remains to be done, particularly in relation to spills of hazardous materials. Effective response equipment and techniques are required. Contingency plans must identify geographical areas by their susceptibility to pollutants if optimum strategies are to be arrived at during responses to pollution incidents.

Need

Protection of Birds. Water bird populations often are harmed severely by large oil spills. Methods to keep birds from landing in waters affected by acute discharges of oil or hazardous materials should be developed.

Present Activities

Bird repelling equipment exists in the form of noise making devices. They are marginally successful and lose their effectiveness as birds become accustomed to the noises produced by the devices.

Analysis

1. Innovative ways to keep birds from oiled areas should be developed. Ideally a nontoxic chemical that can be sprayed on oiled water surfaces would be easiest to use.

Need

Shoreline Vulnerability Classification. Various shoreline types within a coastal zone are not equally vulnerable to spilled oil or hazardous chemicals. Coastal habitats need to be classified according to their vulnerability. The information can then be incorporated in contingency plans for responding to pollution incidents in these areas.

Present Activities

Techniques for classifying shoreline areas with respect to ecological sensitivity have been proposed. Although a great deal of work has been done in the past, general agreement has not been reached as to the criteria for accomplishing this. A comprehensive mapping of vulnerable areas has not been carried out.

Analysis

Standard guidelines for classifying the vulnerability of coastal areas should be established. An effort should then be undertaken to catalog the classification of coastal regions within the United States.

Need

Oil Spill Containment and Recovery Systems. Oil containment and recovery equipment that is deployable and will function in the highest sea states that oil can be expected is needed.

Present Activities

Devices exist that will function in five foot, wind driven seas. An ongoing program to improve operating procedures is expected to permit the

equipment to be used safely in seven foot seas.

Analysis

1. Refinements in operating procedures and existing systems are expected to permit oil to be recovered in up to 10-foot seas. Tests on the natural dispersion of oil slicks indicate that most oils will be driven into the water column when sea conditions exceed ten to twelve frost wind driven seas. A program of refining existing technology is therefore recommended. The current level of effort is considered appropriate.

Need

Spill Response Chemicals. Spilled oil penetrates sand, causing damage to burrowing invertebrates,and heavier oils tenaciously coat rocks. In these situations, cleanup efforts can be as disruptive of ecosystem integrity as is the spill itself. Shoreline damage from these causes could be lessened if nontoxic chemicals could be sprayed on a jeopardized beach to make sand less permeable and oil less adherent to rocks.

Present Activities

Efforts to date have included pretreatment of beaches with dispersants and surface collecting agents. Success has been marginal, and concern has been raised about the toxicity of the agents.

Analysis

1. Increased activity in this area is very desirable and has the potential for greatly reducing damage to beach areas.

Need

Hazardous Chemical Spill Response Equipment. Better equipment and techniques to clean up hazardous chemical spills are needed.

Present Activities

An active program is being carried out by EPA and the Coast Guard

to determine methods to detect, identify, and mitigate the threat posed by spills of hazardous chemicals. The problem is extremely complex. Although progress is being made much work remains to be accomplished.

Analysis

1. The current planned program is considered appropriate. Further coordination between the principal agencies is recommended to reduce the potential for duplication and maximize the potential for carrying out piggyback development.

Need

Separating Oil from Water. Oil recovery devices recover a mixture of oil and water. A means to separate water from the recovered oil, possibly with a nontoxic chemical demulsifier, would greatly reduce the logistics of oil recovery operations.

Present Activities

Efforts are underway to develop a mechanical oil-water separator for this purpose. Several commercial firms claim to have developed such a demulsifier.

Analysis

1. Arrange for operational tests of existing chemicals.

2. Test toxicity of any demulsifiers shown to be successful. Future plans should be developed after the results of the above tests become available.

Need

Measurement of Oil Slicks. Oil spilled on the ocean becomes a series of variable patches rather than a single concentrated mass. These patches differ in size and concentration. A means is needed to measure the amount of oil in a given slick so that cleanup operations may be directed toward slicks posing the greatest threat to environmentally or economically sensitive areas.

Present Activities

Electronic air surveillance monitoring equipment has been developed that can detect the presence of oil on the surface of the ocean under any weather conditions. The device, however, can only crudely estimate the amount of oil in a slick.

Analysis

1. State-of-the-art sensors from other applications should be tested in existing surveillance packages. Additional development should be undertaken only if these sensors fail to yield acceptable results.

Need

Definition of Harm. For enforcement purposes the harmful quantity of a polluting substance must be defined and must be readily measureable. The existing definition of a harmful quantity of oil is a visible sheen. This definition meets the above criteria. However, controversy exists about its validity. Better scientific bases for defining harmful quantities of oil and hazardous substances are needed.

Present Activities

Quantities of oil that may be harmful in territorial waters of the U.S. and the contiguous zone are defined as a visible sheen. No definition exists beyond the contiguous zone. An EPA notice of proposed rulemaking has designated package units as harmful quantities of hazardous substances.

Analysis

Research is needed to validate these criteria or to propose equally enforceable substitute definitions. The activity is crucial to the Federal enforcement program and should be given the highest priorities.

Need

Oil Dispersant Effects. In defined situations, the Environmental Protection Agency and U.S. Coast Guard can authorize use of chemical dispersants to remove spilled oil from water surfaces. There is a continuing controversy concerning the possible effects the use of dispersants might have on the environment. Research should be performed to resolve this matter and to develop effective chemical dispersants having lesser health and environmental side effects.

Present Activities

Limited joint industry-government (EPA and NOAA) programs are being conducted on the open ocean testing of dispersants. Results on environmental concerns have been inconclusive to date. Tests to develop operational procedures have been performed and have been successful in general.

Analysis

1. A joint industry-government effort should be initiated to define the questions that must be addressed to determine the possible side effects of utilizing dispersants. A program to obtain the data necessary to address the key issues should then be planned and implemented.

Need

Scientific Response. Although undesired, polluting incidents provide a unique opportunity to study the effects of a pollutant on the natural environment. If the capability to marshall a competent, effective scientific team exists, much useful information can be gained regarding pollutant behavior and effects. Such information is also valuable to future risk analysis efforts. Participating scientists would also be available to provide support to cleanup personnel on environmental

matters. The capability to mount effective scientific response to polluting incidents should be developed and maintained.

Present Activities

The National Response Team of the National Oil and Hazardous Substances Contingency Plan calls for NOAA and EPA to designate personnel as Scientific Support Coordinators (SSCs) in the coastal and inland regions of the ten Federal regions. SSCs are responsible for coordinating post spill damage assessments and research at a spill of opportunity. They are also required to organize local scientists to provide scientific support to the Federal On-Scene Coordinators, the individuals responsible for insuring that prompt actions are taken to remove and/or mitigate the effects of the pollutants. To date several SSCs have been designated.

Analysis

1. The remaining SSCs should be designated and the local network of scientists established for each region of the country.

2. Funding for scientific support teams should be identified as a budget line item.

Need

Detection of Hazardous Materials Dumping. In recent years considerable illegal dumping of hazardous materials has taken place in coastal wetlands, and other remote areas. Surveillance techniques should be developed to detect these activities and dumpsites.

Present Activities

The Toxic Substances Control Act (TOSCA) and Resource Conservation and Reclamation Act (RCRA) form the framework of a mechanism for maintaining control over hazardous chemicals from the cradle to the grave. To date no regulations have been issued to implement these acts. Prototype in situ

sensors are also being developed to detect certain classes of chemicals. Aerial photography has been successfully used to detect repositories for hazardous wastes. Some 300 chemicals have recently been designated as hazardous substances. The discharge of designated harmful quantities of these substances will be a violation of the Federal Water Pollution Control Act (FWPCA) effective in June, 1979. The Coast Guard and Environmental Protection Agency will maintain a system of surveillance on land, water, and air to enforce these regulations.

Analysis

1. Prompt enforcement will deter illegal dumping.

2. The development of in situ sensors should be continued. Their use is more likely to be to detect illegal discharges in remote locations where discharges frequently occur.

3. Continued and improved use of aerial surveillance to determine extent of damage is recommended.

Need

Development of Spill-Response Capability for Ice-Infested Regions. Offshore oil development has begun in Alaska and it is expected to increase substantially in the coming decade. There is also considerable oil transport through Alaskan and Northeastern U.S. waters when ice is present. There is a need to develop procedures and equipment to detect, control, and cleanup and/or abate oil pollution in ice-infested waters.

Present Activities

The Coast Guard has performed a comprehensive study of pollution response needs in ice-infested regions. They have performed initial investigations of oil detection and movement and modified some pollution response equipment

for active use. However, existing capability falls far short of near-term need. The Coast Guard work is coordinated with the Canadian Department of the Environment's Arctic Marine Oil Pollution Program which has similar goals.

Analysis

Develop procedures and equipment to detect, control and cleanup oil pollution in ice-infested waters of Alaska, the Northeast, and the Great Lakes.

D. IMPACT ON HEALTH, LIVING RESOURCES AND RECREATION

In carrying out the foregoing analysis of the Federal effort to address specific ocean pollution problems, it became apparent that ongoing and future research activities should be undertaken within a comprehensive, system-oriented research design. There are certain research and development and monitoring needs that are basic in nature, but are required in order to guarantee that suffucient scientific background is available to identify and solve problems and to recognize how research on specific problems fits into comprehensive protection of the marine environment. In looking at these needs, it was evident that they fall into three general categories that can be affected by pollution: human health, living resources and recreation.

Human Health

Ocean pollution has direct and indirect impact on human health. Directly, health can be affected if humans are in physical contact with coastal waters that are contaminated with pathogens or toxins. Indirectly, health can be affected by bioaccumulation and concentration of these materials in the food chain from sea creatures to man. Many of man's ocean use activities are sources of pollutants which are a threat. However, not all ocean pollution research, development and monitoring should be directed toward uses.. Some should be directed toward human health, but focus on the direct and indirect toxic effects of pollutants regardless of source.

Needs in the human health area that have not been specified previously include the following:

o The need to determine the health effects of microorganisms, synthetic organics and other pollutants entering the food chain.

o The need to identify, evaluate and rank potential human health hazards resulting from ocean pollution,

o The need to determine the human health effects of direct contact with ocean pollutants.

Living Resources

Oceans and estauries are the life-support systems of living marine resoiurces. Fish, crustaceans, mollusks, aquatic plants, birds, and mammals serve human needs and desires related to food uses, industrial and medicinal uses, education, and aesthetics. World commercial landings (including production from aquaculture) of marine and anadromous fish, shellfish and plants increased from 33.6 million metric tons to 60.0 million metric tons in 1975.

Important recreational activities are also supported by living marine resources. In the United States in 1970, an estimated 715,000 metric tons of fish were taken by marine sport fishing alone. The number of marine sport anglers increased from 6.3 million in 1960 to 9.5 million by 1970, and their expenditures increased from $626 million in 1960 to an estimated $1.8 billion by 1975.

The Federal program should recognize the regional differences in living resources and supporting ecosystems and develop a coordinated approach comprosed of three study elements: (1) characterization of selected eco-

systems and communities; (2) field and laboratory experiments on the effects of pollution in biota; and (3) ecosystem modeling.

Needs in the living resources areas that have not been specified previously include the following:

o The need to identify biological control factors within ecosystems that are particularly sensitive to pollution.

o The need to characterize changes which have occurred in natural areas as a result of pollution and to determine whether such changes can be reversed.

o the need to identify critical habitats for populations of marine animals, seabirds, and marine endangered species that are most vulnerable to pollution threats.

Recreation and Aesthetics

Recreation is one of the largest and fastest growing uses of the coastal zone. With 75 percent of our national population concentrated in 30 coastal states, there is tremendous demand for access to waterways and shoreline for recreational uses ranging from swimming, water skiing, boatong and diving to painting, wildlife observation, shell collecting, sun bathing, and simply enjoying the landscape. Swimming, boating and fishing are the most popular recreational activities.

In 1975, 48.7 million Americans spent $4.8 billion while using 9.7 million boats service by 5,995 marinas. Of this $4.8 billion, $1.8 billion is direct economic impact of marine recreational fishing.

In estimating the potential damage from marine pollution, aesthetic values are often ignored because it is difficult to qualify the benefits. The quality of the ocean environment is an intangible asset that belongs to all mankind.

Needs in the recreation and aesthetics area that have not been specified previously include the following:

o The need to determine the availabliity of and demand for marine recreational resources and to estimate the value to those resources to society.

o The need to quantify the potential value loss to marine recreation from marine pollution, particularly petroleum and pathogens.

o The need to identify regional and national public goals and values for marine recreation as it relates to other marine resources uses.

o The need to identify and evaluate alternative multiple uses of coastal and ocean areas and potential conflicts between pollution activities and increased recreation.

o The need to develop regional marine pollution indices that effectively communicate the quality of the marine environment to the general public.

o The need to evaluate the importance of the aesthetic value of the marine environment, including the "contemplative" value of unspoiled natural habitats and potential loss to this value due to marine pollution.

III. NATIONAL NEEDS

Analyses in the previous section have been rigorous in comparing the current Federal effort with needs to develop information of use to decision makers on pollutants, regional problems, and sources of pollution. During this evaluation, common needs became apparent that require a special organizational approach beyond that applicable to specific information needs. This section presents those common needs, which much be considered high priority, for monitoring, measurement technology, quality assurance, and information dissemination. It then presents a priority ranking of the needs for regional impacts and sources of pollution developed in the previous section. (These preliminary designation of priorities were developed through consultations with involved agency representatives and through the public workshop at Tysons Corner, Va. All priorities are preliminary and subject to change.)

A. Common Needs

The Federal Program for Ocean Pollution Research, Development, and Monitoring must satisfy a broad array of information needs. To accomplish this, effective coordination and management of the Federal effort is essential. In reviewing specific ocean pollution problems that need attention and the existing Federal Program, it is apparent that there are common needs that will facilitate more effective management and systems ongoing and planned activities. These common needs are summarized below.

1. MONITORING

One of the key sources of information about the health and safety of our coastal oceans and its resources comes from marine pollution monitoring activities. The basic, overriding purpose for monitoring marine pollution is to obtain time-series data sets that can be used to detect significant

change in the measured parameters, and to utilize this information to provide timely warning and other advice to management so appropriate actions may be taken.

Marine pollution monitoring can be defined as systematic, time-series observations of predetermined pollutants or pertinent components of the marine ecosystem over a length of time that is sufficient to determine the (1) existing level, (2) trend, and (3) natural variations of the measured parameters in the water column, sediments, or biota.

Research and marine pollution monitoring are mutually supportive activities. Monitoring -- i.e., systematic, time-series observations of phenomena to determine their existing level, trend, and natural variations -- may be part of a research strategy. On the other hand, to initiate an actual, operational monitoring activity, research is needed to determine what components of the given ecosystem or what pollutants should be monitored, what should be the frequency of observations, how long a phenomenon should be observed and what area, and how the observations should be interpreted. Pollution monitoring needs fall into four categories:

1. Surveillance of pollutant inputs, such as operational discharges of industrial and domestic effluents and ocean dumping. The purpose of this activity is to set guidelines and standards, to check compliance with regulations, and to ensure that pollutant dispersion characteristics and effects are within previously established limits.

2. Monitoring of the ecosystem (water body, sediments, and biota) to determine potential hazards to human health and marine biota, to assist in developing or refining of control strategies and environmental indicators, and to advance research and technology for the protection of human health and the marine ecosystem.

3. Monitoring of food resources to determine their safety for human consumption. These activities are routinely performed to check whether viral or bacteriological microorganisms, toxic metals, or pesticides are present in seafood at known harvesting areas subject to pollutant impacts. The results are used to protect the public from consumption of contaminated seafood and to regulate fishing and shellfishing areas.

4. Monitoring of spills, i.e., the existence, fate, and dispersion of hazardous substances, entering the ecosystem via accidents. Activities are usually short-term and concerned with the immediate ecological and human health impacts. Results are used to provide warning to local authorities and the public about expected impacts, and to guide containment and clean-up operations.

The key pollutants that need to be monitored include synthetic organics, chlorination products, artificial radionuclides, disease causing micro-organisms, trace metals, nutrients, and fossil fuel compounds.

Evaluation: Approximately $14.5 million, or 10 percent of the Federal Marine Pollution Research and Development and Monitoring Program was spent on actual monitoring operations in FY 1978. Of these funds $2.1 million (14 %) was used for surveillance of pollutants inputs, $8.5 million (58 %) for monitoring of the ecosystem, and $3.2 million (23 %) for monitoring of food resources. No funds were identified specifically in the Federal inventory for monitoring of spills -- these activities were financed by other operational activities of the Federal Agencies and form part of the funds listed the "other" or "support" category. It is estimated that approximately $3 million were spent on activities related to monitoring of spills, bringing the total marine pollution monitoring effort to $17.5 million, or roughly 12 percent of the total Federal Program.

The distribution of the marine pollution monitoring efforts for FY 1978 by Federal Agencies is the following: EPA $7.3 million (50 %), HEW $3.1 million (21 %), DOI/BLM $2.7 million (19 %), DOI/FWS $0.8 million (6 %), and NOAA $0.6 million (4 %). Again, it is estimated that EPA, NOAA, and DOT/CG spent another one million dollars each on monitoring of hazardous materials spills, which funds are part of the "support" category of the Federal inventory.

Operational Monitoring activities in the Great Lakes region total $4.5 million (31 %), in the Northeast Atlantic coast $4.7 million (33 %), and Gulf of Mexico $2.7 million (19 %). The remaining $2.6 million (18 %) is roughly evenly distributed among all the coastal regions of the United States.

In FY 1978 EPA spent $4.4 million on the Great Lakes program, $0.4 million on the Chesapeake Bay program, $1.5 million on Ocean Dumping monitoring, $0.4 million on the National Pollution Discharge Elimination System compliance, and it is estimated that $0.6 million out of a total of $11.3 million is the direct marine part of the State and inter-state agency monitoring activities support. Miscellaneous smaller programs received $0.04 million.

HEW's National Shellfish Sanitation program received $2.3 million, the pesticide and metals in fish program was funded at the $0.8 million level.

The DOI/FWS program efforts for FY 1978 were the following: National Pesticide Monitoring Network for Birds -- Wetland, $0.12 million; National Freshwater Fish Monitoring Network - Estuaries, $0.1 million; Trans-Alaska Pipeline - Port Valdez, $0.15 million; Great Lakes Surveillance, $0.06 million; Sturgeon and Striped Bass in San Francisco Bay, $0.25 million; and miscellaneous programs, $0.06 million. DOI/BLM spent $2.7 million on monitoring related to OCS Environmental Studies.

The DOC/NOAA FY 1978 monitoring programs included $0.08 million for Prince William Sound hydrocarbon monitoring, $0.06 million for Chesapeake Bay, $0.44 million for Northeast Coastal United States, and $0.05 million for miscellaneous small monitoring activities.

Conclusion: The review and analysis of the Federal monitoring efforts indicate that with the exception of an adequate concern for the long-term, chronic, sublethel effects of pollution of the Nation's coastal waters, the present monitoring efforts may be responsive to the most critical needs. The combined monitoring efforts of private industry, and local, State, and Federal governments are intended to assure that the general public is protected from health hazards caused by the consumption of contaminated seafood products and exposure to polluted swimming areas. The monitoring of hazardous materials spills in the coastal waters is adequately accomplished through an interagency effort primarily run by the Coast Guard, the EPA, and the NOAA.

Although there are programs for effluent monitoring, beach surveillance, shellfish monitoring, and monitoring of the dumping and spills of hazardous materials, most of these efforts are in areas where the problems already have been identified, and are oriented toward some specific local concerns. Many areas of the country that are not near to major urban and industrial centers are not being actively monitored for pollutants. Monitoring in these areas usually ensues after a deleterious event or activity has been identified. This is a crisis response philosophy; the approach should be one of prevention. A large part of prevention is, of course, source control, but a systematic, regional monitoring program of the coastal ecosystem should be able to alert State and Federal agencies to potentially dangerous pollution situations before these actually occur.

It is essential to have private industry, local, State, and Federal agencies involved in a cooperative marine pollution monitoring program. Each have specific needs and concerns with varying perspectives. The key problem is that often their efforts are conducted without the knowledge of each other, and data and information are not readily available to share among potentially interested managers.

To remedy this situation allpertinent monitoring of industry, local, and State and Federal agencies should be coordinated as part of a National Ocean Pollution Monitoring Program. A Federal Agency should oversee that this coordination is established, that the pollution monitoring information is converted into "management - use" products, and that regional pollution monitoring programs are implemented to take care of the long-term concerns of our coastal ecosystems.

The management and organizational needs that have to be accomplished are considered equal in importance to those of the scientffic needs: These are:

o Establish federally funded and managed ocean pollution monitoring programs for each highly stressed coastal region of the United States

o Federal agencies, and states, should coordinate their monitoring programs for specific coastal regions and discrete bodies of water.

o Establish a management information system and a central data bank for all of the existing local, State, and Federal marine pollution monitoring programs, and their data.

o An Interagency Steering Committee be established to advise on the establishment and implementation of a National Ocean Pollution Monitoring Program.

o Provide for the interpretation and synthesis of monitoring information and data products and establish an effective transfer of these to managers and the public.

o Guidelines should be established for quality controls in monitoring data acquisition and analysis technology. Federal data and analysis technology relevant to marine pollution should meet these guidelines. Federal support of relevant academic and industry research and monitoring should require adherence with the guidelines.

o Monitoring data acquisition format should be standardized. Monitoring and research efforts should be increased by the Federal agencies to develop, test, and adopt standard marine bioassay methods.

o An increased Federal effort should be directed toward advancing monitoring instrumentation technology (sensor development) and analysis methodology.

o Designate a lead Federal agency responsible for the coordination and management of the National Ocean Pollution Monitoring Program, and provide staff for a management group.

2. MEASUREMENT TECHNOLOGY

Measurement technology is an area of development that applies to almost all programs, for this reason it deserves special recognition. It is frequently the limiting factor in developing meaningful information for ocean pollution problems. Reliable field and laboratory measurement systems, accurate and repeatible testing techniques, and sample collection equipment which permits sampling consistency and does not alter or contaminate samples are all prerequisites essential for carrying out meaningful research and monitoring. Present state of the art measurement of virtually all chemical and biological parameters is limited to laboratory techniques and not in-situ

measurements. Methods are not standardized and few laboratories have the capability of performing analyses with acceptable accuracy and precision. Methods are labor intensive, expensive and not easily automated or transferrable to the field.

Development in the measurement area is frequently underemphasized in the competition for scarce dollars, partially because development often requires substantial lead time and cannot produce immediate results. As a result, research and monitoring are performed, but data may be questionible, or worse yet, accepted as definitive, when in fact, measurement and sampling error may provide an information base inadequate for decisionmaking or comparative purposes.

A special emphasis is required in the measurement technology area since development will benefit all agencies in almost all areas of ocean pollution, research, and monitoring. Some interagency collaboration is already underway; such efforts should be expanded.

Needs

Develop standardized and automated laboratory procedures and techniques for analyses of trace metals, toxic materials, and nutrients to allow comparison of data from different sources.

Develop reliable accurate in-situ sensors and portable systems for measuring trace metals, toxic substances and nutrients. Such systems are needed in situations where laboratory analysis of individually collected samples is not efficient or adequate such as (1) unattended monitoring from buoys or structures, (2) obtaining ground truth for remote measurement systems, (3) monitoring compliance for pollutant discharge limits, (4) controlling pollutant levels in controlled ecosystem experiments, and (5) where expected pollutant and biological activity is patchy requiring large quantities of data for study.

Develop standardized and automated sampling systems for collection of uncontaminated water, sediment and organism samples.

Develop bioassay techniques and associated equipment for evaluating response of benthic and free swimming organisms to complex mixes of pollutants in the laboratory and in the field. Explore the feasibility of using biological organisms as indicators of pollution and as concentration mechanisms for low level pollutants in the marine environment.

Develop standardized procedures and equipment for evaluating the sublethel effects of pollutants on organisms and their behavior.

Assess the relative roles of remote sensing, in-situ and laboratory measurements for use in ocean pollution research and monitoring taking into account the spatial coverage, accuracy and capabilities of various types of measurement techniques and platforms. Measurement strategies should include the use of cost-effective mixes of measurement techniques and platforms.

In 1978 $7.5 million was spent for development of measurement systems to support ocean pollution research and monitoring programs. Largest emphasis in the area, more than half, was placed on development of remote measurement systems. The greatest portion of this, $2.1 million, was used primarily by the Coast Guard for surveillance equipment; $1 million was used by other agencies for development of additional remote sensing capabilities. Less than $700,000 was used for development of other types of sensors and detection systems. The other half of the measurement development program, $3.7 million, was used for development of chemical and biological methods and systems, for measurement and testing related to ocean pollutants. One million eight hundred thousand dollars was directed at chemical methods for petroleum, pesticides and water quality parameters; an additional $1.8

million was directed toward biological measurements. Biological programs were funded almost entirely by EPA, primarily for development of (1) bioassay techniques, (2) methods for detecting pollutants in organisms, (3) organisms as indicators of pollution, (4) ecosystem toxicity testing techniques, and (5) equipment for organism and ecosystem toxicity testing.

3. QUALITY ASSURANCE

Quality assurance cuts across all aspects of the Federal ocean pollution research, development, and monitoring program; it is a necessary element for accountability in regulatory and enforcement programs and could be a major means of achieving increased efficiency and cost reduction in research and monitoring programs.

In order for the information developed through the Federal Program to provide adequate information upon which to base policymaking for use of the Nation's oceans, and to serve as a basis for regulatory and adjudicatory decisions, quality assurance is of paramount importance in its development and dissemination. Unfortunately, allocation of resources to quality assurance programs is usually done with great reluctance, and although many programs claim to have quality control, external signs of quality assurance are seldom visible.

Quality assurance involves insuring the maximum reliability for each measurement. Reliability is maintained through the use of standardized techniques, instrumentation and methodology along with adequate auditing procedures throughout all stages of sampling, measurement and recording in both the field and laboratory. It is essential that information be reported on measurement uncertainty, including errors inherent in sampling, instrumentation, and analytical techniques, and that this information be retained with the original data to be made available to secondary users. Key needs for quality assurance are:

o Develop "tools" for use in quality assurance programs. (1) Handbooks of standard methodology for sampling, analysis and reporting; (2) standards (traceable to national and internationally accepted standards) for calibration of equipment and measurement systems; (3) stable reference samples

for intercalibration programs; and (4) standard procedures for test, evaluation and calibration of field instrumentation and performance requirements for design.

o Establish adequate surveillance programs including a continuing inter-facility measurement comparison program.

o Establish requirements for periodic certification of analytical laboratories.

o Maintain a listing of accredited private, academic and Federal facilities with capabilities for testing, calibration and performance of ocean pollution research and development and monitoring activities.

Evaluation: Less than 1 percent of the current Federal program ($856,000) was spent on quality assurance programs in 1978, by EPA, NOAA, and DOE. Both the Coast Guard and BLM plan to initiate small programs in 1979. In 1978, 38 percent ($330,000) of the quality assurance program was spent on the development of reference samples and chemical methods comparisons. An additional 27 percent ($235,000) was spent developing tools and standards for instrument calibration and comparisons. Only $65,000 was directed to the calibration of operational field instrumentation. The remaining $227,000 in the program was for interlaboratory comparison of bioassay procedures and toxicity testing.

4. DATA AND INFORMATION DISSEMINATION

In order to assure that the maximum benefit is obtained from ocean pollution research, development, and monitoring activities, adequate consideration must be given to establishing a mechanism for dissemination of information derived from these activities. Two very important concerns are that the information be available in a timely manner and in a useful form. It will be of little use to decisionmakers if the neces-

sary base of information lags years behind today's problems. Likewise, to be of maximum use the information, when available, must be in a form which is easily understandable to the average individual.

Particular concern must be given to see that the resulting monitoring phases of the program are delivered to users in the shortest possible time. Large amounts of data are likely to be collected, stored, and retrieved during monitoring operations.

In evaluating the national needs for marine pollution related information, there are two levels of information needs. The first level, management information, is required in order to assure that projects are properly run, goals and objectives are being met, and results are available in the shortest possible time. This type of system would normally require that the particular agency funding the project submit the project information at the earliest possible stage in the planning process. If possible, the information should be updated during the operational phase.

Management information on completed and ongoing work related to type of research activity, geographical area of investigation, funding agency, performing agency, principal investigation and project goals should be included in this type of system.

The second level of information needs includes data and information generated as a result of the work itself. Significant gains in the utility of Federal ocean pollution research, development and monitoring programs can be achieved through centralized storage of these types of information. The intent of this centralized accumulation of information is twofold. Initially, the usefulness will be to assure that all results and findings will be obtainable by contacting one source. An additional benefit will be achieved by utilizing the information in the system to

determine whether or not additional research, development, and monitoring projects should be supported.

Evaluation: Present data and information systems and programs can be classified according to the following categories of information systems:

- "Hard data systems, which contain alphanumeric records of actual measurements or observations.
- Data referral systems, which index or inventory data collections and contain only descriptions of data files.
- Bibliographical information systems, which contain citations to books, journal narticles, technical reports, and other publications.
- Document distribution systems, which disseminate copies of technical reports and other publications.
- Management information systems, which contain information about scientific projects: project name, sponsoring organization, name of principal investigation, source of funding, and personnel information.

Agencies of the Federal Government are responsible for the dissemination of information relevant to their own programs. Many of the government's systems, while being large and comprehensive, are not directly related to, or in support of, ocean pollution, research, and development and monitoring activities.

Although most of these activities are single purpose, they do serve the overall needs of marine pollution activities in some respects. These include the DOA, DOC, DOD, DOE, HEW, DOI, DOT, and EPA.

Problems which have handicapped the dissemination of marine pollution data have been the inherent multidisciplinary nature of these types of data. Traditionally, Government agencies have not distinguished pollution

data and information from normal data and information efforts. For example, the National Technical Information Service of the Department of Commerce is the central point in the United States for the public sale of Government-funded research and development reports and other analyses prepared by Federal agencies, their contractors, or grantees. This collection exceeds one million titles. However, only a fraction of these are related to marine pollution. A similar case is with the Notice of Research Project file of the Smithsonian Institution. This activity maintains a file of all current research activities -- whether or not they are pollution related.

Conclusions: A complete data and information service system is needed to support ocean pollution research, development, and monitoring activities including planning and data management through delivery of published results. The establishment of an Ocean Pollution Data and Information Network is recommended to meet those needs. The main purpose of this system would be to serve the needs of the general public and be responsive to the needs of secondary data users, those who use environmental data and information subsequent to the use for which the data were originally intended. The proposed system includes components that have three basic functions:

(1) The Subject Area Data/Information Center -- where numeric and textual environmental data are available, generally covering one subject area or discipline.

(2) The Depository -- where textual information is available.

(3) The Central Coordination and Referral Office -- where inventories of environmental data and information, and management information about ocean pollution programs, can be obtained.

An effective data and information operation needs a substantial commitment in money and people from agency management. A percentage of the funds appropriated for ocean pollution research, development, and monitoring programs should be allocated to support the data and information systems program. Experience has shown that a 3- to 4-percent surcharge on data collecting activities is adequate to maintain such a system.

Implementation: Section 8 of PL 95-273 designates NOAA as the lead Federal agency responsible for the dissemination of information relevant to ocean pollution research, development, and monitoring. Consistent with that is the recommendation that NOAA be designated as the Central Coordination and Referral Office within the proposed Ocean Pollution Data and Information Network.

The Central Coordination and Referral Office plays a major role in the implementation of the data and information system. This office provides a single stop service to assist the public and others in their search for data and information concerning, or resulting from, ocean pollution research, development, and monitoring programs. Two primary functions of this office are:

Referral: A central referral point is needed where the public can be supplied or receive direction about its ocean pollution data and information needs.

Management: A management role is required to direct the subordinate data and information activities, and to analyze the overall Federal efforts.

The Central Coordination and Referral Office, because it is the most visible and the most important component of the proposed data and information system, should receive priority consideration in the

implementation of P.L. 95-273. The activities of this office to a certain degree exist today.

SUMMARY OF COMMON NEEDS

MEASUREMENT TECHNOLOGY

1. Standardized and Automated Procedures. Develop standardized and automated procedures and techniques for analysis of trace metals, toxic materials and nutrients to facilitate comparison of data from different sources.

2. In-Situ Sensors and Portable Systems. Develop reliable, accurate in-situ sensors and portable systems for measuring trace metals, toxic substances and nutrients.

3. Automated Sampling Systems. Develop standardized and automated sampling systems for collection of uncontaminated water, sediment and organism samples.

4. Bioassay Techniques. Develop bioassay techniques and associated equipment for evaluation of response of benthic and free-swimming organisms to complex mixes of pollutants in the laboratory and in the field; explore the feasibility of using organisms as indicators of pollution and as concentration mechanisms for low-level pollutants in the marine environment.

5. Integrated Measurement Sysytems. Assess the relative roles of remote aircraft and satellite sensing, in-situ sensing and shore based laboratory measurements for comprising cost effective, integrated measurement schemes for use in ocean pollution research and monitoring taking into account the spatial coverage, accuracy and capabilities of the various types of measurement techniques and platforms.

QUALITY ASSURANCE

1. Laboratory Certification. Establish requirements for periodic certification of analytical laboratories.

2. Listing of Accreditied Facilities. Maintain a listing of accredited private, academic, and Federal facilities with capabilities for testing, calibration and performance of ocean pollution research, development and monitoring activities.

3. Quality Assurance "Tools". Develop "tools" for use in quality assurance programs including: (1) handbooks of standard methodology for sampling, analysis and reporting; (2) standards (traceable to national and internationally accepted standards) for calibration of equipment and measurement systems; (3) stable reference samples for intercalibration programs; and (4) standard procedures for test, evaluation, and calibration of field instrumentation and performance requirements for design.

4. Auditing. Establish adequate audit programs including a continuing interfacility measurement comparison program.

5. Quality Assurance Guidelines. Establish guidelines for quality control in monitoring, data aquisition and analysis technology to be met by all relevant federal and federally supported academic and industrial research and monitoring programs.

HUMAN HEALTH

1. Health Effects From Food Chain Accumulation. Undertake selected studies to determine the human health effects of microorganisms, synthetic organics, and other pollutants entering the marine food chain.

2. Risk Analyses of Health Hazards. Perform risk analyses to identify, evaluate, and rank potential human health hazards resulting from ocean pollution.

3. Health Effects of Direct Contact. Determine the human health effects of direct contact with ocean pollutants.

LIVING RESOURCES

1. Ecosystem Sensitivity. Identify biological control factors within ecosystems that are particularly sensitive to pollution.

2. Lessons from Impacted Areas. Use impacted areas to identify effects of pollution by characterizing changes in natural areas and recovery rates of impacted areas.

3. Critical Habitats. Identify critical habitats for populations of marine animals, sea birds, and marine endangered species that are most vulnerable to pollution threats.

RECREATION AND AESTHETICS

1. Regional Surveys of Recreational Resources. Perform regional surveys of the availability of, and demand for, marine recreational resources including

estimates of the value to society of such resources.

2. Value Loss. Estimate the potential value loss to marine recreation from marine pollution, particularly petroleum and pathogens.

3. Goals and Values. Identify regional and national public goals and values for marine recreation as it relates to other marine resource uses.

4. Alternative Ocean Uses. Identify and evaluate alternative uses of coastal and ocean areas and potential conflicts of pollution activities with increased recreation.

5. Regional Indices. Develop regional indices of marine pollution levels that effectively communicate to the general public the "environmental quality" of the oceans.

6. Aesthetic Value. Evalute the importance of the aesthetic value of the marine environment to society including the "contemplative" value of unspoiled natural marine habitats and the potential loss to this value due to marine pollution.

RECREATION

(L) 1. Pollution Generated by Recreation. Determine the amounts and kinds of pollution resulting from marine recreation, their importance, and what, if anything, need be done.

(L) 2. Habitat Disruption. Determine the impact of recreational activities that disrupt habitats, including the development of objective assessments of ecosystem impacts, extent of damage, and cost and benefits to support management of recreational resources at the state and federal regulatory level.

(L) 3. Marina Design. Develop criteria for marina design so that flushing characteristics can be maximized and alteration of circulation patterns can minimized in local environments.

(L) 4. Need for Marine Sanitation Devices on Recreational Craft. Determine whether chlorinated domestic wastes from small recreational boats are more or less harmful than untreated wastes and whether wastes can be pumped directly overboard from small craft into coastal and estuarine waters.

LIVING RESOURCES

(L) 1. Fish and Shellfish Processing Wastes. Document the kinds of pollutant problems caused by fish and shellfish processing wastes and evaluate their

ecologic significance. The extent to which these wastes are facility location or treatment problems should be examined.

(L) 2. Hatchery and Aquaculature Wastes. Evaluate wastes from hatchery and aquaculture facilities for pollution consequences so that the need for waste treatment can be determined.

(L) 3. Disease Transmission. Determine the potential for fisheries processing wastes serving as a vehicle for transmission of human and fish pathogens and evaluate the risk from such transmission.

B. REGIONAL PRIORITIES

In this section preliminary priorities have been assigned within regions; high (H), medium (M) and low (L)

North Atlantic Region

(H) 1. Georges Bank Oil and Gas Exploration. Assess and monitor the probable effects of impending oil and gas exploration and possible development on Georges Bank, especially on local ecosystems and highly productive fisheries.

(M) 2. Spill Damage Assessment. Assess the damage from probable oil and hazardous materials spills to determine the need for protection of high value recreational areas and rare and endangered species habitats.

(M) 3. Powerplant and Oil Refinery Sitings. Assess proposed coastal powerplant and oil refinery sitings, include surveys, research on effects, and conceptual and numerical models.

(H) 4. Waste Disposal. Assess the environmental impacts of waste disposal near major coastal urban centers.

Middle Atlantic Region

(H) 1. New York Bight Area. Develop a comprehensive, coordinated scientific program to obtain environmental, economic, and social information upon which to base future environmental, resource, and waste-management decisions in the New York Bight area.

(H) 2. Chesapeake Bay Assessment. Carry out a comprehensive assessment on the effects of agricultural and urban runoff, sedimentation, nutrients, and sewage on the biota of Chesapeake Bay, particularly on its aquatic vegetation, in order to determine the long term viability and sustenance of this system.

(H) 3. Environmental Monitoring. Develop a system for monitoring not only the water quality but the long term fate and effects of pollution in this coastal region, particularly around the New York Bight and Chesapeake Bay.

(M) 4. OCS Oil and Gas Development. Determine the impact of outer continental shelf oil and gas development; including surveys, research, monitoring, and modeling of the offshore and coastal systems.

(M) 5. Evaluation of Post Long Island Sound Studies. Evaluate past studies in Long Island Sound to determine long term trends (on the order of 50 years) of the impact of human activities on this body of water. High priority should be given to evaluating the extent to which sewage and other materials can be disposed of in open water and the consequences of these actions on the living resources.

(H) 6. Assessment of Fish and Shellfish Stocks. Assess and monitor the stocks of fish and shellfish of the area in order to protect the public from contaminated seafood.

South Atlantic Region

(H) 1. Estuarine Ecosystems. Develop an understanding of estuarine ecosystems, and their links with oceanic fishes, through a comprehensive research program including laboratory and field studies and modeling, in order to determine to what extent habitats can be stressed before altering the balance within the ecosystem.

(M) 2. Nonpoint Source of Pollution. Carry out comprehensive studies to determine the fates and effects of nonpoint source inputs of pollutants in selected estuarine systems such as those around Savannah, Ga., and Charleston, S.C., and within the barrier island system.

(M) 3. OCS Oil and Gas Development. Determine the potential impacts of OCS oil and gas development in this region, with particular concern for the effects of OCS activities on estuarine dependent fisheries and offshore shellfish beds.

(M) 4. Oil Spills and Discharges off Southern Florida. Carry out selected impact and recovery studies for potential oil spills and operational discharges on coral reefs, mangrove habitats, and recreational resources off sourthern Florida.

(M) 5. Sand Dredging near St. Thomas, V.I. Assess the environmental implications of offshores and dredging near St. Thomas and determine the effect this may have on the near shore biota.

(L) 6. Pharmaceutical Waste Dumping near Puerto Rico. Determine the fate and effects of the dumping of pharmaceutical wastes at oceanic disposal sites near Puerto Rico.

(H) 7. Habitat Preservation of Endangered Species. Perform a comprehensive study of the degree of habitat preservation (by such means as designation of refuge areas, limited access areas, etc.) required for the propagation of endangered marine species, especially ocean turtles and manatees, two species particularly suffering from coastal development.

Gulf of Mexico Region

(H) 1. Nonpoint Source Pollutants from the Mississippi River. Determine the effects and fates of nonpoint source pollutants carried by the Mississippi River into the Northern Gulf.

(M) 2. Long Term Effects of Petroleum Development. Determine the long term (longer than 25 years) effects of petroleum development on living resources and offshore and nearshore environments in order to facilitate historical ecological comparisons.

(M) 3. Louisiana Wetland and Estuarine Assessment. Assess the effects of wetland and estuarine modifications along the coast of Louisiana including the effects of channeling, dredging, filling, and spoiling and the extent to which physical alteration can be continued before productivity of the ecosystem is permanently lost.

(L) 4. Petrochemical Industrialization on Galveston Bay and the Texas Coast. Determine the long term effects of increasing petrochemical and industrialization on Galveston Bay and the Texas coast in order to develop means to protect the aquatic environment and public heatlh.

(H) 5. Development in West Florida Coastal Embayments. Determine the long range effects of increasing coastal development on the West Florida coastal embayments in order to establish to what extent an area, such as Tampa Bay, can assimilate the impacts of urbanization and industrialization.

(M) 6. Disposal of Brine from Salt Dome Storage Sites. Monitor and study the dispersion of brine disposal from salt dome storage sites for the Strategic Petroleum Reserve.

(M) 7. Drilling Mud Discharges on the Flower Gardens Banks. Monitor and assess the effects from drilling mud discharges and other OCS-related activities on the Flower Garden Banks.

Pacific Southwest Region

(M) 1. Petroleum and Mineral Development. Assess the impacts of pollutants associated with marine petroleum and mineral development and transport.

(M) 2. Nonpoint Source Impacts. Determine the effects of nonpoint source pollutants on coastal ecosystems and evaluate the contributions from agricultural chemicals, runoff, aerial fallout, and vessel wastes.

(H) 3. Point Source Ocean Outfalls. Continue investigation of the ecological implications of waste disposal at point source ocean outfalls in Southern California.

(H) 4. Impacts of Geohazards on OCS Petroleum Development. Examine the potential impacts of geohazards on OCS petroleum development.

(H) 5. Impacts of OCS Petroleum Development on Critical Habitats. Assess the potential impacts of OCS petroleum development on offshore critical habitats, particularly the Channel Islands, Santa Barbara Channel, and Tanner/Cortes Bank areas.

Pacific Northwest Region

(H) 1. Effects of Multiple-Source Pollutants on Sensitive Habitats. Identify and assess the impact of multiple-source pollutants on sensitive habitats of migratory marine species (birds, mammals, and anadromous fish).

(M) 2. Effects of Effluents on Puget Sound and San Francisco Bay. Identify and characterize the major marine components and processes which are involved in critical environmental problems related to industrial and municipal effluents in Puget Sound and San Francisco Bay.

(L) 3. Petroleum Development. Examine the potential impact of OCS petroleum development and transhipment on sensitive coastal habitats and identify the potential geological hazards.

(L) 4. Monitoring the Farallon Islands Low-Level Radiation Disposal Sites. Continue monitoring of the low-level radiation disposal site near the Farallon Islands to assess the dispersion, accumulation in the biota, and possible transfer to man of these pollutants.

(M) 5. San Francisco Bay Dredge and Fill Activities. Provide a study of the historical, current, and planned dredge and fill activities in San Francisco Bay and describe the ecosystem impact of these coastal alterations.

Alaska Region

(H) 1. Ice Damage in the Beaufort and Chukchi Seas. Determine the potential of ice shoving, beach overriding, and ocean floor gouging to damage near-shore structures and pipelines in the Beaufort and Chukchi Seas.

(M) 2. Clean-Up of Oil Spills in Ice-Covered Regions. Develop new technology, including biodegradation, to control and clean-up pil spills in ice-covered regions.

(L) 3. Sand and Gravel Removal on the Beaufort Sea Coast. Determine and assess the impact of removal of sand and gravel for construction in the Beaufort Sea coastal zone.

(L) 4. Petroleum Degradation by Microorganisms. Determine the role of Microorganisms in degradation of petroleum in Arctic coastal environments.

(M) 5. Petroleum Development Effects on the Bowhead Whale. Evaluate the threat of petroleum development to the bowhead whale and the reproduction, migratory routes, and overwintering range of these animals.

(H) 6. Pollutants Effects on Sensitive Habitats. Assess and predict the potential effects of pollutants on sensitive habitats, for example, the ice edge, which has been shown to be biologically important and the environmentally fragile Pribilof Islands.

(L) 7. Logging, Pulp Mill, and Fish Processing Effluents. Determine the effects of logging, pulp mill, and fish processing effluents on water quality and ecosystems.

(H) 8. Geological and Physical Hazards. Study the effects of geological and physical hazards on shipping, structures, and pipelines, particularly on Book Inlet, Prince William Sound, and the Beaufort Sea.

Hawaii and Pacific Islands Region

(H) 1. Seabed Mineral Extraction and Processing. Assess the impacts of pollutants associated with potential development of deep seabed mineral extraction and processing.

(L) 2. Radionuclides in Areas of Former Weapons Testing. Assess the fate and effect of radionuclides in areas of former weapons testing.

Great Lakes Region

(H) 1. Multiple Inputs of Pollutants. Monitor and analyze the multiple inputs of pollutants to the Great Lakes paying special attention to the nonuniformity of discharge from whole watersheds and even subbasins.

(H) 2. Diagnostic Management Models of Pollutant Fates and Effects. Develop diagnostic management models of the fates and effects of pollutants entering the Great Lakes.

(H) 3. Fates and Effects of Pollutants from Diffuse Sources. Monitor the fates and effects of the pollutant inputs to the Great Lakes from diffuse sources with particular emphasis on transformation products, remobilization products, and synergistic effects.

C. SOURCE PRIORITIES

In this section preliminary priorities have been assigned to major source categories. In addition, priorities within categories have been indicated as high (H), medium (M) and low (L).

HIGH PRIORITY

COASTAL LAND USE PRACTICES

(H) 1. Inventory of Upstream Sources of Ocean Pollution. Develop and maintain a regional inventory of upstream sources of ocean pollution, including municipal and industrial outfalls, agricultural and urban runoff, dredging and dredged material disposal operations, port operations and recreation.

(H) 2. Estaurine Pollutant Levels. Determine existing levels of critical ocean pollutants in estauries on a regional basis.

(H) 3. Models of Regional Coastal Pollutant Flux. Develop general models for input and flux of pollutants through the narrow coastal region (wetlands and bays to three miles offshore).

(H) 4. Coastal Facility Site Selection Guidelines. Develop use-specific guidelines for coastal facility site selection which take into account environmental, safety, and socio-economic impacts.

(H) 5. Impact of Multiple Facilities. Develop mehtods for adequately assessing the overall impact of multiple facilities in specific geographic regions and carry out these assessments in selected areas.

(H) 6. Coastal Zone Dredging and Channelization. Determine the physical and biological effects of dredging and channelization in the coastal zone on a site specific basis.

(M) 7. Reductions in Aquatic Vegetation. Determine the effects of reductions in aquatic vegetation (marshes, swamps, mangrove forrests, seagrasses, etc.), on productivity and survivability of marine living resources.

MUNICIPLE SEWAGE OUTFALLS

(H) 1. Pollutant Movement and Alteration. Determine the chemical and physical processes which disperse, concentrate, and cycle municipal waste pollutants in the ocean to improve the scope, accuracy, and precision of predictive evaluation of discharge permit applications.

(H) 2. Synthetic Organic Pollutants. Identify sources, distribution, persistence, and bioaccumulation of synthetic hazardous chemicals in the marine environment, including food web transfers and possible pathways to man.

(H) 3. Outfall Monitoring. Determine the degree and rate of recovery of outfall polluted environments after sewage treatment is applied or discharges are stopped.

(H) 4. Sediments. Develop standard methods and criteria for evaluating the pollution content of sediment quality so that suitable treatment technologies and strategies can be chosen.

(M) 5. Biostimulant Research. Evaluate nutrient characteristics of particular inshore marine ecosystems, separating natural from manmade variations and accurately determining the degree and persistence of change that any proposed municipal discharge is likely to produce in order to improve the ability to choose waste water treatment and outfall sites. This is of high priority in the Great Lakes area.

(H) 6. Microbial Pollutants. Determine the risks of introducing microorganisms into the marine environment, including studies on sources, identification of dangerous species, persistence, transformation, measurement, diagnosis of health and ecological effects, development of risk protocols, prevention of microbial contamination, and costs and benefits of abatement and prevention technologies.

(H) 7. Municipal Waste Treatment Technolgoy Improvement. Develop alternative waste treatment technologies, particularly for geographic areas of immediate hazard such as connecting channels of the Great Lakes and the broad continental shelf zone of the Atlantic and Gulf coasts. Technological, ecological, and economic costs and benefits of such technologies should be determined at the pilot feasibility stage or before.

(H) 8. Monitoring Strategies. Develop new monitoring strategies which include consideration of the individual and cumulative effects of outfalls upon large water masses and the ecosystems within them.

INDUSTRIAL WASTE DISPOSAL

(H) 1. Synthetic Organic Pollutants, Metals, and Inorganic Chemicals. Determine the sources, distribution, persistence, and bioaccumulation of synthetic materials, metals and inorganic chemicals in the marine environment, including food web transfers and possible pathways for human exposure.

(H) 2. Industrial Bioactive Compounds. Identify the ecological and economic effects of nutrient-rich industrial wastes in areas where they are significant, such as Puerto Rico, and also determine the costs and benefits of abatement technologies, both existing and under development. Information derived in these research and development activities should be included in predictive risk assessment methods which are under concurrent development.

(H) 3. Monitoring Industrially Polluted Environments. Conduct both ecological and economic analyses of degree and speed of recovery of industrially polluted ocean environments.

RADIOACTIVE WASTE DISPOSAL

(M) 1. Dumpsite Monitoring. Perform ecosystem recovery studies at phased-out dumpsites to determine time and degree of recovery and residual radionuclide abundance, distribution, and ecological effects.

(H) 2. High-Level Radioative Wastes. Evaluate methods for emplacement and for determining potential consequences of disposal of high level radioactive waste in the oceans.

STEAM ELECTRIC POWER PLANTS

(H) 1. Geological Hazards. Assess the geological hazards in the vicinity of operating and proposed coastal nuclear power plants in order to estimate the risk of large-scale radionuclide release as a result of seismic activity.

(M) 2. Ecological Impact of Cooling Water. Evaluate to what extent damage to the young of commerically, recreationally, and ecologically important marine species affects the abundance and distribution of the adults. The impact of low-level chronic thermal stress in combination with effluent chemical pollutants from coastal and offshore power plants should also be evaluated.

(M) 3. Transport of Pollutants from Power Plants. Characterize the physical, chemical, and geological conditions that influence pollutant transport and behavior in the vicinity of coastal and offshore power plants on a site specific basis prior to powerplant siting.

(L) 4. Habit Modification Resulting from Power Plant Construction. Evaluate alterations to sediment transport, current patterns, and ecosystem structure resulting from construction of offshore power plants.

(L) 5. Entrainment and Impingement. Investigate the ecosystem impacts of biological losses resulting from entrainment and impingement of organisms in cooling water systems on a site specific basis.

OIL AND GAS

(H) 1. Geological Hazards. Determine the geological hazards that effect the siting of platforms and other offshore structures paying special attention to sediment instabilities and seismicity. Special problems associated with development in the Arctic, such as the effects of ice gouging and permafrost require additional concern.

(H) 2. Biochemical Effects of Oil. Determine the effects of spilled oil on marine ecosystems and the ability of such systems to recover from spills, especially under Arctic conditions. The effects of long-term chronic discharges of oil must be evaluated in order to predict impact of fisheries.

(H) 3. Detection and Effects of Oil Spilled Under Ice. Develop means to detect the presence of spilled oil under ice and its dispersion as it accumulates in leads and brine ponds, and its effects on migrating marine mammals and birds.

(H) 4. Evaluation of Drilling Technology. Develop the capability for independent evaluation of drilling technology.

(H) 5. Blowouts-Under Ice. Assess the probability, likely effects, and severity of blowouts under Arctic ice and develop methods for control of pollution from such incidents.

(H) 6. Oil Spill Damage Assessment. Develop methods to convert losses of natural resources due to oil spills into equitable monetary values in order to provide answers to questions needed for authorization of reimbursement from the oil spill compensation fund.

(M) 7. Transshipment of Oil and Gas. Evaluate the impact on, and disruption of, biological communities by pipeline construction across beaches and wetlands.

(M) 8. Preventive and Safey Technology for Platforms and Pipelines. Develop techniques and equipment, including unmanned remote controlled equipment, to improve the non-distructive testing and inspection of platforms and pipelines and to detect promptly, smaller discharges from pipelines.

(M) 9. Discharges from Drilling and Production Operations. Determine the physical transport and ecological effects of drilling muds and cuttings particularly on sensitive marine areas such as coral reefs, fish and shellfish spawning and nursey areas, and bottom communities in the vicinity of drilling platforms. A variety of overboard discharge methods for operational drilling platform wastes should be investigated and, based on this information, protocols should be established for composition and disposal of discharges of concern.

(M) 10. Oil Spill Trajectory Analyses. Improve techniques for presenting the results of oil spill trajectory analyses in easily understandable forms so that important differences between alternatives can be highlighted.

(L) 11. Biological Characterization for the OCS Leasing Process. Identify important living marine resources and their habitats that may be impacted by OCS oil and gas development so that appropriate protective measures can be developed.

TRANSPORT OF HAZARDOUS MATERIALS

(H) 1. Assessment of Risk. Obtain better information on general traffic routes for hazardous chemicals, trends in quantities transported, and the hazards of new chemical products.

NAVIGATIONAL AND OPERATIONAL STANDARDS

(H) 1. Personnel Error. Analyze past pollution incidents to determine ways to avoid placing operating personnel in situations that lead to human error.

(M) 2. Redundant Equipment on Vessels. Carry out additional research on the relative reliability among various safety systems on vessels.

(M) 3. Vessel Design Research. Determine methods for optimizing the location of strategically placed segregated ballast.

(L) 4. Emergency Cargo Transfer Systems. Determine the utility of requiring emergency cargo transfer systems on tank vessels.

OIL TRANSPORTATION

(M) 1. Pollution Threat from Lightering. Evaluate the threat of pollution from lightering operations off the coast of the United States.

(M) 2. Development of an Oily Water Discharge Monitor for Vessels. Develop an oily water monitor for installation on vessels that will indicate and record, when ballast or bilges are discharged and whether the oil content of these discharges exceeds the internationallly agreed limit.

(L) 3. Hazards of Nuclear Propulsion Vessels. Continue evaluation of the risks of pollution posed to the marine environment from large-scale use of nuclear propulsion vessels.

RISK ANALYSIS

(H) 1. Risk Analysis Techniques. Develop risk analysis techniques which include social and economic factors and potential for human error for use in decision making relative to marine pollution.

(H) 2. Methods for Evaluation of Losses. Establish standard methods for evaluating losses of value and natural resources resulting from incidents of accidental discharge, for liability determinations.

(H) 3. Mathematical Models for Risk Analysis. Develop improved models which include mixing processes and toxicity effects in order to perform risk analyses and to assist personnel involved in planning clean up and mitigation strategies during response actions.

SPILL CLEANUP AND RESPONSE

(H) 1. Protection of Birds. Develop refined methods to keep birds from landing in waters affected by acute discharges of oil or hazardous materials.

(H) 2. Shoreline Vulnerability Classification. Classify coastal habitats according to their vulnerability and incorporate this information in contingency plans for responding to pollution incidents in selected critical areas.

(M) 3. Oil Spill Containment and Recovery Systems. Develop oil containment and recovery systems that are deployable and will function in high sea states.

(H) 4. Spill Response Chemicals. Develop nontoxic chemicals that can be sprayed on beaches jeopardized by spills in order to protect organisms by making sand less permeable and rocks less prone to oil coating.

(H) 5. Hazardous Chemical Spill Response Equipment. Develop better equipment and techniques to clean up and mitigate damage from hazardous chemical spills.

(M) 6. Oil/Water Separator. Develop a means to separate oil from the oil/water mixture that is obtained during clean up in order to reduce the logistic difficulties of such operations.

(M) 7. Measurement of Oil Slicks. Develop a means to measure the amount of oil in a given slick so that cleanup operations may be directed toward slicks posing the greatest threat to environmentally or economically sensitive areas.

(H) 8. Definition of Harm. Develop a definition of a harmful quantity of pollution arising from a spill and also means to measure this quantity easily to meet enforcement needs.

(H) 9. Oil Dispersant Effects. Determine the environmental effects of chemical dispersants presently used in certain defined situations to remove spilled oil from surfaces in coastal areas. Research should also be performed to develop more effective chemical dispersants that have reduced health and environmental side effects.

(H) 10. Scientific Response. Develop and maintain the capability to mount effective scientific response to polluting incidents in order to take

advantage of these incidents to gain useful information regarding pollutant behavior and effects.

(M) 11. Detection of Hazardous Materials Dumping. Develop surveillance techniques to permit the detection of illegal dumping of hazardous material, particularly that which takes place in unpopulated wetland areas.

MEDIUM PRIORITY

SEWAGE SLUDGE DUMPING

(M) 1. Pollution Identification. Complete the chemical identification of sludge pollutants at existing sludge dumpsites.

(M) 2. Pollutant Transport and Fate. Complete oceanographic studies of fractionization, dispersion, and distribution of sludge pollutants within the water column and bottom sediments.

(M) 3. Metals and Synthetic Organic Pollutants. Complete studies of bioaccumulation of heavy metal and synthetic organic pollutants attributable to sludge dumps.

(M) 4. Dumpsite Monitoring. Perform ecosystem recovery studies at representative phased-out dumpsites to determine time and degree of recovery and residual pollutant abundance, distribution and ecological effects.

(L) 5. Risk to Human Health. Evaluate risks to human health resulting from sludge dumping at sea so that risk analyses for sea disposal can be compared with risk analyses for land disposal.

DREDGED MATERIALS DUMPING

(H) 1. Prevention Technology. Develop means of dredging and dredge material emplacement to minimize resuspension of materials and to contain

(M) 2. Ecological Impact. Describe the ecological impact of disposal of dredged materials in the coastal environment.
or isolate materials during disposal operations.

(M) 3. Disposal Site Monitoring. Determine the ecological effects of dredge material disposal on both short and long term bases, based on the data obtained during the monitoring of existing and new ocean disposal sites as mandated by ocean dumping regulations.

DEEP SEABED MINING

(M) 1. Characterization of Discharges. Characterize the particle size range, chemical composition, and physical integrity of deep seabed mining particulate discharges.

(M) 2. Fates and Effects of Surface Discharges. Determine the distribution and fate of sediments discharged at the surface and examine the extent to which these discharges stimulate or inhibit plankton populations and whether or not dissolved and particulate discharged material enters the marine food web. This information should be used to evaluate the necessity and practicality of requirements for discharge below the thermocline.

(M) 3. Effects on Deepsea Life. Inventory the species disturded by the mining dredge and describe the effects of the mining process on deepsea life (e.g., masceration, etc.). The rate of recolonization of disrupted areas should also be investigated.

(M) 4. Processing and Production. Determine the chemical and physical properties of wastes arising from shipboard processing of nodules and evaluate the effects of alternative disposal and processing shemes.

SAND, GRAVEL, AND SHELL MINING

(L) 1. Technology Development. Develop mining technology that minimizes the production of a blanket of fine sediment around the mine site. Silt containment and pattern mining to match hydrologic features of the area should be considered.

(L) 2. Long Term Ecological Effects. Determine the long term effects on benthic organisms, as well as fisheries, of substrate alterations caused by the fine sedimentary particles that result from mining operations and eventually blanket the seafloor over large areas and also determine the effects, on both fisheries and coastal erosion, of excavations in the seafloor caused by the removal of sand and gravel on a site specific basis.

(L) 3. Short Term Hazards. Determine the short term effects on the metabolism and survival of organisms confronted with high concentrations of suspended fine sediments in the vicinity of mining activites.

LOW PRIORITY

OCEAN INCINERATION

(M) 1. Evaluation of Concept. Evaluate environmental and economic consequences of ocean incineration as an alternative to land-base disposal of hazardous materials.

OCEAN THERMAL ENERGY CONVERSION (OTEC)

(L) 1. Water Movement Effects. Evaluate the effects of water movements associated with OTEC systems on deep-water animals (mostly fishes) and surface dwelling planktonic and larger species. Entrainment, impingement, entrapment, temperature and presure effects, and nutrient enrichment of surface waters require evaluation for significance and duration.

(L) 2. OTEC Chemical Discharge Effects. Assess the certainties, probabilities, and risks of all possible hazardous chemical releases associated with OTEC systems and chemicals that may be produced when offshore chemical production plants are integreated with OTEC facilities.

(L) 3. Electrical Transmission Problems in the Ocean. Evaluate potential pollution and ecological impacts of underwater or buried sea floor transmission devices associated with OTEC systems and also the hazards arising from accidently serered transmission cables.

OTHER ENERGY TECHNOLOGIES

(L) 1. Geothemal Energy Systems. Evaluate the pollution potential of coastal geothermal energy systems including assessment of the polluting potential of produced brine, thermal discharges, and trace contaminants.

(L) 2. Biomass Fueled Systems. Evaluate the ecological consequences of artifical upwelling of large volumes of nutrient-rich bottom waters for commerical scale kelp farming.

(L) 3 Kinetic Energy Systems . Evaluate the effects on climate and ecology of large scale marine kinetic energy systems which extract wind, tidal, current, and wave energy.

(L) 4. Satellite Power Systems. Evaluate the effects on climate and ecology of ocean located satellite power system receiving antennae.

BRINE PRODUCTING ACTIVITIES

(L) 1. Brine Disposal. Describe the dispersion of brine and assess the effects of its disposal on marine organisms and ecosystems in affected areas.

APPENDIX A

THE ACT AND THE INTERAGENCY COMMITTEE

As a preliminary step in developing the Plan, the Act required that an inventory be made of Federal ocean pollution research and development and monitoring programs and of Federal personnel, facilities, and vessels used in the programs. As a second step it required that a statement of national needs and problems relating to ocean pollution research, development, and monitoring be developed and used to evaluate the adequacy of current Federal programs. The 5-year Plan is the result of the inventory and the analysis of national needs and problems in the light of present Federal ocean pollution research and development and monitoring efforts. It recommends changes in program goals, suggests increases and decreases in program funding levels, proposes measures to improve interagency cooperation, and identifies legislative changes to better satisfy priority research, development and monitoring needs in the Federal sector.

The Act requires that the 5-year Plan be reviewed and updated every 2 years. It also requires that the budgetary process be continually reviewed to ensure interagency coordination and cooperation and to eliminate duplication of efforts in the Federal program.

The Act names the National Oceanic and Atmospheric Administration (NOAA) as the lead agency to develop and implement the 5-year planning process, and further instructs the Administrator of NOAA to establish a comprehensive, coordinated, and effective ocean pollution research and development and monitoring program that will be responsive to the Plan within the Agency. To assist in meeting Plan priorities, not otherwise addressable under present Federal programs, the Act provides funds for

financial assistance. These funds are to be used to address priority needs and can be made available to Federal, State, and local government activities, or to private institutions as appropriate.

Section 8 of the Act addresses the problem of information dissemination and the need to make the results of federally funded ocean pollution research and development and monitoring available for use by both Federal and private users in the decisionmaking processs relating to development and use of ocean resources.

1. INTERAGENCY COORDINATION

The President's Science Advisor and the Administrator of NOAA recognized that full interagency cooperation at the policymaking level was necessary to respond properly to the mandate of the Act. Accordingly, the Interagency Committee on Ocean Pollution Research and Development and Monitoring (COPRDM) was created in June 1978 under the auspices of the Federal Coordinating Council for Science, Engineering, and Technoilogy. NOAA's Deputy Administrator serves as chairman of COPRDM. The Environmental Protection Agency's Assistant Administrator for Research and Development is the Vice Chairman. Federal departments or agencies having significant involvement in ocean pollution research and development and monitoring are represented on the Committee. These are:

Department of Agriculture

Department of Commerce

Department of Defense

Department of Energy

Department of Health, Education, and Welfare

Department of the Interior

Department of Transportation

Environmental Protection Agency

National Aeronautics and Space Administration

National Science Foundation

Nuclear Regulatory Commission

Council on Environmental Quality

Office of Management and Budget

The Interagency Committee formed four working subcommittees to develop specific portions of the 5-year Federal Plan required by Section 4 of the Act. The subcommittees are:

National Needs and Problems, chaired by the principal representative of the Environmental Protection Agency, with responsibility for developing a statement of national needs and problems related to ocean pollution research and development and monitoring, based on input from Federal program managers, scientists, industry, public interest groups, State and local government planning agencies, and groups involved in adjudication of environmental issues.

Research and Development, chaired by the principal representative of the National Science Foundation, responsible for assessing the adequacy of present Federal efforts in ocean pollution research and development and making recommendations to the parent committee on necessary changes to the program.

Monitoring, chaired by the principal representative of the Commerce Department, responsible for assessing the adequacy of present Federal efforts in ocean pollution monitoring and making recommendations to the parent committee on necessary changes to the program.

Data Collection, Storage, and Distribution, chaired by the principal representative of the Department of the Interior, responsible for assessing the adequacy of present Federal efforts in this area and making recommendations to the parent committee on design of a system to make better use of the results of Federal ocean pollution research and development and monitoring in decisionmaking processes relating to the development and use of ocean resources.

In addition to these working subcommittees, a Federal Plan Task Force office has been established with Task Force members representing each of the COPRDM members. The Federal Plan Task Force office is responsible for developing this document (as well as the catalog of Federal programs) based upon the reports of the subcommittees.

APPENDIX B

SUMMARY OF FEDERAL AGENCY PROGRAMS

The Federal Program for ocean pollution research and development and monitoring spent $154,645,000 in fiscal year 1978. Projections for FY 1979 are $145,695,000 and for FY 1980, $157,752,000. There are 11 Federal agencies involved in the Federal Program. In the order of their funding levels in FY 1978, the agencies are:

Department of the Interior
Environmental Protection Agency
Department of Commerce
Department of Energy
National Science Foundation
Department of Defense
Department of Transportation
Department of Health, Education, and Welfare
National Aeronautics and Space Administration
Nuclear Regulatory Commission
Department of Agriculture

Of the Federal Program total budget, 75% was funded for four mission-oriented agencies: Department of the Interior (DOI), Environmental Protection Agency (EPA), Department of Commerce (DOC), and Department of Energy (DOE). Agency funding levels for FY 1978, 79, and 80 are given in table 1.

Agency summaries describe budgeted ocean-pollution-related programs and activities. Major applicable statutory authorities — legislative acts, Executive orders, reorganization plans, and Office of Management and Budget determinations -- that are the mandates for the activities are identified. Agency summaries are arranged by funding levels.

Ocean Pollution

Research, Development, and Monitoring Programs

for 1978 -- 1980

Department of the Interior	$44,932K	$41,884K	$58,431K
Environmental Protection Agency	36,481K	28,364K	28,364K
Department of Commerce	17,538K	22,765K	24,040K
Department of Energy	15,514K	16,804K	15,168K
National Science Foundation	15,534K	15,006K	13,655K
Department of Defense	8,577K	7,066K	6,445K
Department of Transportation	8,809K	8,448K	5,991K
Department of Health, Education, & Welfare	4,113K	3,718K	3,583K
National Aeronautics & Space Administration	1,750K	531K	1,050K
Nuclear Regulatory Commission	1,245K	955K	885K
Department of Agriculture	152K	154K	140K
	$154,645K	$145,695K	$157,752K

1. Department of the Interior

The Department of the Interior accounted for nearly 31% of the total Federal Budget with $44,932,000 spent in FY 1978. This is expected to increase to $58,431,000 by FY 1980. A summary of the DOI budget for FY 1978-80 is presented below.

	FY 1978	FY 1979	FY 1980
Bureau of Land Management	37,737K	35,040K	51,570K
Geological Survey	4,833K	4,899K	4,835K
Fish and Wildlife Service	2,362K	1,945K	2,026K
TOTAL	44,932K	41,884K	58,431K

Within the Department of the Interior (DOI) three agencies carry out ocean pollution research and development and monitoring activities -- the Bureau of Land Management (Division of Marine Minerals Management Assessment), Geological Survey, and Fish and Wildlife Service. Statutory authorities for DOI's activities include the Outer Continental Shelf (OCS) Lands Act of 1953 (which established Federal jurisdiction over submerged lands of the continental shelf seaward of States boundaries), the OCS Lands Act Amendments of 1970 and 1978, and such other authorities requiring mandatory compliance as the National Environmental Policy Act (NEPA) of 1969, Coastal Zone Management Act of 1972, Federal Water Pollution Control Act of 1972, Marine Protection, Research, and Sanctuaries Act of 1973, and Marine Mammal Protection Act of 1972.

The Bureau of Land Management (BLM) is the administrative agency for leasing submerged Federal lands. In this role, BLM is directed to provide

for orderly development of OCS oil and gas resources to meet the energy needs of the Nation, and to provide for protection of the environment concomitant with development of mineral resources, which also include hard minerals such as sand and gravel. BLM-funded research accounted for 85% of the FY 1978 DOI budget of $44,932,000. Protection of the marine and coastal environment is a direct outgrowth of NEPA. The OCS Lands Act Amendments of 1970 imposed the need for Environmental Impact Statements and led to BLM's Environmental Studies Program, to provide information needed to predict, assess, and manage any Outer Continental Shelf and nearshore development that might affect the human, marine, and coastal environments.

The U.S. Geological Survey (USGS) serves Federal, State, and local governments, and the public, by colecting, analyzing, and publishing detailed information about the Nation's energy, mineral, land, and water resources. Although created in 1879 to study geologic structure and mineral resources, Congressional and Executive direction have expanded the Survey's authorities and responsibilities to include topographic mapping, chemical and physical research, stream gaging and water supply assessments, supervision of mineral exploration and development activities on Federal and Indian lands, engineering supervision of waterpower permits, and administration of a minerals exploration program. Ocean-pollution related research and development and monitoring programs are carried out by the Geologic Division, water Resources Division, and Conservation Division.

The Geologic Division conducts geologic research and investigation programs as a background for many economic and social decisions, and to better understand natural processes that influence our lives. Geologic

programs involve four main fields of activity: Land Resource Surveys, Mineral Resource Surveys, Energy Resource Surveys, and Offshore Geologic Surveys. Offshore surveys assess the potential mineral and energy resources of the continental margins and include studies to determine the geological and environmental hazards that may affect offshore development, including the siting of offshore drill rigs, production platforms, and pipelines.

The Water Resources Division of the USGS has the principal responsibility at the Federal level for appraising water resources, for providing hydrologic data on surface and ground water, and for providing water information needs at all levels of government. The Division's Federal-State Cooperative Program includes 597 State and local agencies which provide financial support and services, matching funds appropriated by the Congress. It keeps the Federal Government aware of State and local problems and contributes to a valuable exchange of information through a network of offices in all 50 States, and in Puerto Rico and Guam. In 1964 the USGS was designated the lead agency for coordinating water-data-acquisition activities of all Federal agencies, including information on streams, lakes, reservoirs, estuaries, and ground water. This has minimized duplication among Federal agencies, and has improved the data base and its accessibility.

The Conservation Division performs regulatory functions under laws governing leasing, mining, and use of mineral and water resources on Federal and Indian lands. It supervises operations associated with the exploration, development, and production of minerals from leased Federal, Indian, and Outer Continental Shelf lands, including the collection of royalties and certain rentals which result from mineral production.

Regulation of OCS oil and gas activities is a continuing process, requires constant review of program components and objectives, and can become more complex as production activities are undertaken in hostile new environments.

The U.S. Fish and Wildlife Service (FWS) is involved in environmental research and operational activities under mandates of the National Environmental Policy Act (NEPA), the Fish and Wildlife Coordination Act, and other Federal legislation. Three interrelated FWS programs deal with environmental issues. The Land and Water Resource Development Program, managed through the Division of Ecological Services, provides ecological input to field-level planning related to specific river basin studies and projects to be constructed by Federal agencies, assisted with Federal funds, or constructed by non-Federal entities under a Federal license or permit. It assures FWS compliance with NEPA.

The Environmental Contaminant Evaluation Program conducts research, monitors contaminants, and makes field appraisals to ascertain the effects of pesticides, industrial chemicals, heavy metals, and pollutants on fish and wildlife and their habitats. It manages and reviews all FWS uses of pesticides and is directed toward determining relationships between the application of pesticides and damage to fish and wildlife.

The Biological Services Program was created to assess impacts of new land and water development more rapidly and keep abreast of projects related to energy, impairment of wetlands, and proposed changes in land and water use. This program is the coordinating link between FWS field operations and research and management activities. It supports research and studies on critical environmental problems, prepares guidelines and manuals, and provides technical assistance to help FWS participate in the

decisionmaking process for major resource development projects. Through the program FWS advises BLM and the USGS on ecological problems associated with development of oil and gas resources on the outer continental shelf, including the least damaging ways to bring oil and gas ashore and the best locations for shore-based facilities. FWS is identifying critical zones that should not be developed and is analyzing alternatives to preserve critical areas while projects are in an early planning stage and options are still available.

2. Environmental Protection Agency

The second largest portion of the Federal Program is accounted for by EPA, which funds nearly 23% of the total program. EPA's FY 1978 budget was $36,481,000 and is expected to be $28,364,000 by FY 1980. A summary of the EPA budget for FY 1978-80 is presented below.

	FY78	FY79	FY80
Health Effects (HERL/Cincinnati)	511K	401K	365K
Pollutant Transport (ERL/Athens)	6K	6K	0K
Oil and Hazardous Materials Prevention and Cleanup Research (IERL/Cincinnati)	2,279K	2,370K	1,292K
Great Lakes (ERL/Duluth)	2,032K	878K	453K
Marine Ecology (ERL/Corvallis)	1,433K	1,347K	630K
Marine Ecology (ERL/Gulf Breeze)	4,504K	3,477K	2,895K
Marine Ecology (ERL/Narragansett)	3,309K	2,721K	2,316K
Chesapeake Bay Studies	5,969K	5,969K	5,969K
EPA Energy/Environment Interagency Program	3,715K	3,687K	3,687K
Basic Water Quality Monitoring Program	6,950K	1,450K	1,450K
Evaluation of Radioactive Waste Dumpsites (ORP)	545K	830K	900K
Ocean Dumpsite Evaluation Program (OWHM)	1,500K	1,500K	1,700K
Great Lakes National Program	3,728K	3,728K	3,200K
Unobligated funds	0	0	3,507K
TOTAL	36,481K	28,364K	28,364K

The Environmental Protection Agency's (EPA) involvement in ocean use policy and management derives from the Federal Water Pollution Control Act as amended by the Clean Water Act, the Marine Protection, Research, and Sanctuaries Act, the National Environmental Policy Act, the Rivers and Harbors Act, and U.S. legislation implementing international treaties and agreements. EPA uses a variety of regulatory strategies to implement these mandates including water quality criteria, Federal Discharge criteria, guidelines for private and governmental ocean use activities, and permits for certain activities, such as point-source waste discharges.

EPA regulations are prepared by program offices and reviewed by an Agency Steering Committee composed of all program offices: Office of Water and Hazardous Materials, Office of Toxic Substances, Office of Enforcement, Office of General Counsel, and Office of Research and Development. The review considers such aspects as scientific validity, legality, enforceability, and consequences with respect to economic policy. Regulatory activities include classifying compounds or materials as hazardous substances, which, when spilled or discharged into marine waters, require specific cleanup actions, and can result in penalties on the discharger.

EPA permit activities are concerned with coastal development and recreation, especially the siting of powerplants and refineries, dredging and filling activities, and recreational water quality. EPA-issued permits can stipulate special requirements, such as review of waste treatment plans and schedules and monitoring at disposal sites.

Waste disposal activities are a primary responsibility of EPA. They include ocean dumping, incineration at sea, ocean outfalls, and riverine

pollution. Main types of waste are sewage sludge and other municipal waste, industrial waste, radioactive waste, atmospheric and land nonpoint-source waste, and dredged material.

EPA shares some regulatory responsibilities with other Federal agencies such as the Corps of Engineers, which issues permits for disposal of dredged materials in navigable waters in accordance with EPA prepared guidelines. It also acts in an advisory capacity to the Bureau of Land Management in leasing arrangements on the outer continental shelf. An operational function of EPA's regulatory responsibilities is to review permits and to advise and assist States and municipalities in establishing and maintaining coastal and marine management programs. Through such functions as the Municipal Construction Grants Program, EPA can influence specific activities, such as the degree of treatment required for municipal sewage discharged by outfalls.

Enforcement responsibilities generally are left to the States. Federal intervention usually occurs only when the States fail to enforce, when they request assistance, or when a problem has implications across State boundaries. EPA maintains enforcement officers in its 10 Regional Offices, but some enforcement actions are handled by the Headquarters enforcement component.

EPA's R & D program addresses all major ocean use activities within EPA's purview. It provides the scientific basis for its regulatory and enforcement processes through (1) information used to develop and update criteria and guidelines and establish policy relating to the environment, and (2) a cadre of resident experts who participate in enforcement proceedings and rulemaking hearings in which EPA is involved.

3. Department of Commerce

The major ocean pollution research, development and monitoring activities of the Department of Commerce are those of the National Oceanic and Atmospheric Administration (NOAA). Additional programs are carried out from time to time by NBS and MARAD. In FY 1978, NOAA had the third largest agency budget for ocean pollution-related work, with a total of approximately $17,538,000 or 11% of the total Federal Program. This funding is expected to increase to over $24 million in FY 1980.

	FY78	FY79	FY80
NOAA			
Marine Ecosystems Analysis Program (MESA)	6,157K	7,438K	4,713K
Fisheries Habitat Investigation Program	1,902K	2,200K	2,200K
Fisheries Microconstituent Program	3,519K	3,495K	5,311K
Great Lakes Environmental Research Program	2,512K	2,512K	2,512K
Sea Grant Program	2,360K	2,712K	2,712K
Ocean Engineering Program	398K	398K	398K
Other Projects	135K	135K	135K
BLM Support	64K	64K	64K
Long-Term Effects Program	0	2,785K	4,790K
Maritime Administration	0	0	0
National Bureau of Standards	0	0	0
Total:	17,538K	22,765K	24,040K

Additional NOAA effort is supported through the interagency transfer of funds from other Federal agencies. The Outer Continental Shelf Environmental Assessment Program (OCSEAP) is funded entirely ($21.9 million) by the Bureau of Land Management to study environmental conditions and potential impacts of oil and gas development in Alaska. EPA transfer funds supported NOAA's pollution research efforts in FY 1978 at the $2.7 million level.

Thus, when interagency transfers of funds are considered, NOAA ranks first in the direct conduct or management of Federal expenditures on ocean pollution research, development, and monitoring. A summary of the NOAA base budget for FY 1978-80 is provided below.

NOAA's responsibility for planning and coordination of Federal ocean pollution research and development and monitoring is mandated in P.L. 95-273, the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978. NOAA's mission in marine research is defined by Reorganization Plan No. 4 of 1970 and in numerous legislative acts including:

- o The Marine Protection Research and Sanctuaries Act of 1972 (P.L. 92-532)
- o The Fishery Conservation and Management Act of 1976 (P.L. 94-265
- o Fish and Wildlife Act of 1956
- o Sea Grant Program Improvement Act of 1976 (P.L. 94-461)

NOAA is the lead civilian agency for dealing with the oceans as a multiple use resource that both must be exploited and conserved, while still preserving the unique, renewable characteristics of the ocean environment. Major NOAA funded activities in Ocean Pollution Research and Development and Monitoring include the Marine Ecosystem Analysis program (MESA), the National Marine Fisheries Services Habitat Investigation and Microconstituent program, the Great Lakes environmental research program, the Sea Grant Program, the Ocean Dumping and Monitoring Program, the Long-Term Effects Program, and the Office of Ocean Engineering.

The Marine Ecosystems Analysis (MESA) program is composed of a series of projects established to determine the "state-of-health" of regional marine

coastal ecosystems where significant management and environmental quality problems exist or are anticipated.

The MESA program is a focus for organizing and coordinating studies and evaluations of the effects of pollution and other man-induced changes in ocean ecosystems, and the effects of major disasters (natural or man-induced) on the marine environment.

The Fisheries Habitat Investigations program examines the effects of man-induced and natural changes on the abundance, distribution and functioning of living marine resources of commerical and recreational importance.

The Fisheries Microconstituent research program is composed of two complementary but distinct research areas: (1) qualitative assessment of the impact of contaminants on the fishery resources and their habitat, and (2) assessment of the impact of contaminants on the utilization of fishery resources from a public health standpoint.

The Ocean Dumping Program exists in response to Section 201 of P.L. 92-532. The Program designs, supports, and manages marine research and monitoring projects that aply to industrial, municipal, and dredged material waste dumping sites.

The Office of Sea Grant awards grants for research and development, education and training, and advisory services in all fields related to the development and utilization of marine resources and the marine environment.

The Great Lakes Environmental Research Laboratory (GLERL) was established to develop environmental information on the Great Lakes region that is useful to decisionmakers.

The program is multidisciplinary in scope, ensuring the best possible utilization of the region's resources.

The Long-Term Effects program assesses the possible long-range effects of ocean pollution and other man-induced stresses on the marine ecosystem. The major thrust of the program is to identify and, where necessary, recommend corrective action with respect to potentially serious problems in the oceans before they reach a crisis stage or become uncontrollable.

The Office of Ocean Engineering conducts a comprehensive ocean engineering program that provides for the advancement of technology to develop oceanographic instruments and systems for measurements required in both national and NOAA ocean programs; the development and advancement of engineering capabilities and technologies necessary to support NOAA activities in ocean and coastal zone management, climate research and monitoring, and environmental protection.

Three other DOC components have ocean-pollution-related activities, but no funding was reported for FY78: the Maritine Administration (MarAd) under the Federal Water Pollution Control Act of 1972, as part of its commercial vessel operations and pollution abatement responsibilities; the National Bureau of Standards, which is responsible for establishing standards of measurement and related analytical methodology; and the National Technical Information Service (NTIS), which was created by the Congress in 1950 (Title 15, U.S.C. 1151-1157) as a clearing house of U.S. and Foreign government-sponsored research, development, and engineering reports and for other analyses prepared by national and local government agencies, their contractors or grantees, or special technology groups.

4. Department of Energy

In FY 1978, the Department of Energy (DOE) spent $15.5 million on ocean pollution research, development, and monitoring, nearly 10% of the total Federal Program. This funding level is expected to remain approximately level through FY 1980. A summary of the DOE budget for FY 1978-80 is presented below:

	FY78	FY79	FY80
Regional Programs	6,543K	4,891K	4,747K
Ocean Thermal Energy Conversion (OTEC)	1,359K	2,038K	2,772K
Strategic Petroleum Reserve Office (SPRO)	4,513K	6,726K	4,500K
Other Programs	3,099K	3,149K	3,149K
Total:	15,514K	16,804K	15,168K

The Department of Energy (DOE) was established in 1977 from the former Energy Research and Development Administration (ERDA) and several other government entities. Its mandates relate to development and use of energy sources and effects of energy technlogies, including nuclear power -- a mandate passed to ERDA in 1975 from the former Atomic Energy Commission (AEC). Programs involving marine pollution include: administration of the Strategic Petroleum Reserve within restrictions of the National Environmental Policy Act (NEPA) of 1969, particularly disposal of brines in the Gulf Coast regions of Louisiana and Texas; development of marine-related energy conversion technology, such as ocean thermal energy conversion (OTEC), waves, tides, currents, and salinity gradients; and management of R&D (by

the Office of Health and Environmental Research) on the environmental effects of energy-related pollutants — including their release, transport, and fate in the coastal zone, pathways and fates from different sources into physical and biological systems, and the resilience of biological systems to disturbance by energy activities. Research work is conducted by university contractors and within DOE facilities. Regional ocean areas under study include the Northwest Atlantic by the Brookhaven National Laboratory, South Atlantic Bight by Skidaway Institute of Oceanography, California Coastal Areas by Scripps Institution of Oceanography, and the Pacific Northwest Coast by University of Washington. Research includes movement of trace metals and radionuclides in rivers, estuaries, and coastal waters, resulting concentrations in marine life, and effects of oil spills and heated water release.

5. National Science Foundation

The National Science Foundation spent $15,134,000 in FY 1978, approximately 10 percent of the total Federal Program. This is expected to remain level or increase slightly by FY 1980; actual level of support will depend upon unsolicited proposals.

The National Science Foundation (NSF) supports, but does not itself conduct, research on basic oceanographic questions relevant to ocean pollution problems through its division of Ocean Science and the International Decade of Ocean Exploration (IDOE) program. Most research is conducted at academic institutions, but industrial-academic projects are possible. Many of NSF's sponsored studies are of value in predicting the movement and fate of pollutants and assessing the response of individual species and biological communities to stresses that could lead to irreparable damage. The IDOE program of the 1970s supported international

research teams and globally planned and coordinated studies. IDOE's Environmental Quality Program, which was designed to provide information on the quality of the marine environment and to assess and predict man's impact on the ocean, included four major investigations: Geochemical Ocean Sections Study (GEOSECS), Pollutant Transfer Program, Biological Effects Program, and Controlled Ecosystem Pollution Experiment (CEPEX).

6. Department of Defense

Research funded by the Department of Defense (DOD) amounted to $8,577,000 in FY 1980. This is expected to decrease to $6,445,000 by FY 1980. A summary of the DOD budget is provided below.

	FY78	FY79	FY80
Army Corps of Engineers	2,140K	1,857K	1,967K
Navy	6,437K	5,209K	4,478K
Total:	8,577K	7,066K	6,445K

Department of Defense (DOD) ocean pollution research and development and monitoring activities primarily are those of the Department of the Navy and Army Corps of Engineers. Most U.S. Navy environmental research is in response to its special operational needs and environmental quality standards established by other regulatory agencies. It relates to problems of sewage and solid waste disposal, polluting effects of antifouling technology, oil/water separator systems, ballast wastewaters, water monitoring for ordnance compounds, and toxic waste reduction and treatment. The Army Corps of Engineers has a major national role in civil works programs and specific responsibilities in waterways management. It studies effects of waste disposal at open-water sites, effects of dredging,

use of dredged material, habitat development, assessment of marsh and estuarine environments, prediction and control of erosion and sedimentation, benthic population dynamics, beach and shore stability, and the interaction of environmental and socioeconomic forces affecting coastal development.

7. Department of Transportation

The U.S. Coast Guard funds DOT's contribution to the Federal Program for Ocean Pollution research, Development, and Monitoring. In FY 1978, the DOT budget amounted to $8,809,000 and is expected to be approximately $6,000,000 in FY 1980. A summary of the FY 1978-80 budget is provided below:

	FY78	FY79	FY80
Coast Guard:			
Marine Environmental Protection	8,405K	8,223K	5,999K
Commercial Vessel	284K	225K	0K
Port Safety	120K	0K	0K
Total:	8,809K	8,448K	5,999K

In the Department of Transportation (DOT), the Coast Guard has primary responsibility for the safe movement of vessels in marine transportation and for the quality of the marine environment with regard to the transport of oil and hazardous chemicals within the ports and on the waterways of the United States. Statutory authorities for these responsibilities derive in part from the Ports and Waterways Safety Act, Port and Tanker Safety Act, Tank Vessel Act, Federal Water Pollution Control Act, and Dangerous Cargo Act. To accomplish these tasks, the Coast Guard regulates and enforces minimum standards of design, construction, alteration, repair, maintenance, and operations of vessels; controls or supervises

operations along the waterfront and vessel traffic; and regulates and enforces the handling, storage, and carriage on vessels of all dangerous and hazardous materials, such as explosives, flammable liquids and solids, oxidizing materials, corrosive liquids, compressed gases, and poisonous articles. Under the Federal Water Pollution Control Act, the Coast Guard also has responsibility for preventing oil and hazardous substances pollution from vessels and transportation-related facilities and mitigating discharges of oil and hazardous substances from any sources in coastal zone, ports, harbors, Great Lakes or resulting from activities on the Outer Continental Shelf and for pollution that can affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States, including resources under the Fishery Conservation and Management Act of 1976. Further, the service works to improve safety and prevent pollution at sea in its role as the coordinating U.S. representative in the Intergovernmental Maritime Consultative Organization (IMCO) of the United Nations.

An active research, development, monitoring program is carried out to support the Coast Guard's marine environmental protection, commercial vessel safety, and jport safety programs. Much of the work in the latter two program areas is performed, primarily to enhance safety and protect life property. While almost all of these efforts result in a reduction in the potential for pollution only those that are specifically intended to detect or reduce pollution are included in this plan. Operating programs such as the facility and vessel inspection programs and pollution surveillance programs are also not included.

Most research, development and monitoring efforts in support of the above named programs are performed within the commercial sector. The missions

are also supported, however, through the Coast Guard's Research and Development Center and Shipboard Fire and Safety Testing Facility.

8. Department of Health, Education, and Welfare

The Department of Health, Education, and Welfare (HEW) budget for FY 1978 was $4,113,000; this is expected to remain approximately level through FY 1980. A summary of the FY 78-80 budget is provided below.

	FY78	FY79	FY80
National Institutes of Health	1,278K	1,148K	1,013K
Food and Drug Administration	2,835K	2,810K	2,810K
Total	4,113K	3,958K	3,823K

In the Department of Health, Education, and Welfare (HEW) two components of the Public Health Service -- the National Institutes of Health (NIH) and Food and Drug Administration (FDA) -- conduct and support research and manage programs relating to ocean pollutants and their effects on human health. NIH, with responsibilties for prevention and treatment of disease and promotion and protection of human health, conducts studies through its Institute of Environmental Health Services on biological effects of environmental contaminants. FDA, which is responsible for the purity and quality of foods in interstate commerce, inspects canned and processed seafoods and administers the National Shellfish Sanitary Program (NSSP) -- a Federal-State-industry program for sanitary control of the shellfish industry. Only oysters, clams, and mussels are included in this program, which FDA coordinates at the Federal level without regulatory, licensing, or enforcement authority. State agencies manage program operations and monitor, classify, and control approximately 14.1 million

acres of shellfish waters -- State territorial waters out to 3 miles. Approximately 600 square miles of sludge dumping sites off New York Harbor and Delaware Bay are monitored, in cooperation with EPA, NOAA, and Coast Guard, for sea clam growing waters and sediments. Research on contaminants includes viral and bacteriological microorganisms, toxic metals, radionuclides, and naturally occurring marine toxins.

9. National Aeronautics and Space Administration

The National Aeronautics and Space Administration spent $1,750,000 on ocean pollution development work in FY 1978. The funding is expected to be $531,000 in FY 1979 and $1,050,000 in FY 1980.

The National Aeronautics and Space Administration (NASA) was established by the National Aeronautics and Space Act of 1958 (P.L. 85-568). The Act specifies that activities in space are to contribute to the most effective use of the scientific and engineering resources of the United States -- through close cooperation with interested Federal agencies and authorization of NASA to enter into agreements with any State, political subdivision, or public and private agencies. Although NASA does not have a direct statutory responsibility for any monitoring activity, the Congress has directed other agencies to seek NASA's assistance and has directed emphasis of NASA projects through specific actions. The Federal Water Pollution Control Act of 1972 (P.L. 92-500) charges the Administrator of EPA to use the resources of NASA and other agencies in establishing, equiping, and maintaining a water-quality surveillance system. NASA Authorization and Appropriations actions for 1978 identify support for the application of space technology in detecting and monitoring oil spills in U.S. waters and controlling other pollution problems.

NASA's marine pollution activities include analysis and interpretation of remotely sensed data relating to Great Lakes water quality, investigations of ocean dumping and environmental baseline monitoring in the coastal zone, study of red tide and coastal zone water quality characteristics, and use of electrochemical methods to detect and monitor coliforms in coastal waters. Much microwave sensor work relates to methods and systems to remotely observe and model oceanic phenomena.

10. Nuclear Regulatory Commission

The FY 1978 budget for ocean pollution research, development, and monitoring for NRC was $1,245,000. This funding level is expected to decrease to $955,000 in FY 1979 and $875,000 in FY 1980.

The Nuclear Regulatory Commission (NRC) is directed by the Energy Reorganization Act of 1974 to perform research to confirm specific problems encountered during the nuclear regulatory process. NRC performs little direct research or monitoring. It stimulates monitoring programs by applicants for licenses and by those who are granted licenses. These include: baseline studies prior to submitting applications, preoperational studies that focus on problems identified during baseline studies, and postoperational monitoring to assure compliance with license conditions. Baseline studies provide information needed by NRC to prepare the Safety Analysis Report and the Environmental Impact Statement. Operational monitoring programs by licensees focus on potential radionuclide pathways to man. NRC provides guidelines on radiological environmental monitoring for routine operations of nuclear facilities, including measuring, evaluating, and reporting radioactivity in solid wastes and releases of radioactive material in liquid and gaseous effluents from light water cooled nuclear powerplants. NRC's Office of Inspection and Enforcement contracts

with 16 States to perform "spot check" monitoring for quality assurance, and maintains an in-house capability for radiological monitoring in response to specific incidents and as part of the NRC emergency preparedness program. In January 1979 monitoring programs were being conducted at 23 sites of proposed or operating nuclear facilities in the coastal zone.

11. Department of Agriculture

The Department of Agriculture spent $152,000 in FY 1978 for ocean pollution research, development, and monitoring. This funding level is expected to be maintained at $154,000 for FY 1979 and $140,000 for FY 1980.

Most Department of Agriculture (DOA) ocean pollution research and development and monitoring efforts are directed to reducing detrimental effects of agricultural practices on the quality of the environment -- the problems caused by runoff and waste disposal, offsite and downstream effects of sediments, nutrients, and pesticides, transport and transformation of pollutants, and their effects on different organisms and ecosystems. Emphasis is on management and use of the Nation's soil, water, and air, and on reducing pollutants in receiving estuarine, lake, and ocean waters. Research is accomplished through inhouse efforts, cooperation with State and other universities, and by contracts and grants. Statutory authorities for research include the Department of Agriculture Organic Act of 1862 (5 U.S.C. 511), Research and Marketing Act of 1946 as amended (70 S.C. 427, 4271), National Agricultural Research, Extension, and Teaching Policy Act of 1977 (P.L. 91-113), and other Congressional mandates.

Public Law 95-273
95th Congress

An Act

May 8, 1978
[S. 1617]

To establish a program of ocean pollution research, development, and monitoring, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Ocean Pollution Research and Development and Monitoring Planning Act of 1978".

National Ocean Pollution Research and Development and Monitoring Planning Act of 1978.
33 USC 1701 note.

SEC. 2. FINDINGS AND PURPOSES.

33 USC 1701.

(a) FINDINGS.—The Congress finds and declares the following:

(1) Man's activities in the marine environment can have a profound short-term and long-term impact on such environment and greatly affect ocean and coastal resources therein.

(2) There is a need to establish a comprehensive Federal plan for ocean pollution research and development and monitoring, with particular attention being given to the inputs, fates, and effects of pollutants in the marine environment.

(3) Man will increasingly be forced to rely on ocean and coastal resources as other resources are depleted. Our ability to protect, preserve, develop, and utilize these ocean and coastal resources is directly related to our understanding of the effects which ocean pollution has upon such resources.

(4) Numerous departments, agencies, and instrumentalities of the Federal Government sponsor, support, or fund activities relating to ocean pollution research and development and monitoring. However, such activities are often uncoordinated and can result in unnecessary duplication.

(5) Better planning and more effective use of available funds, personnel, vessels, facilities, and equipment is the key to effective Federal action regarding ocean pollution research and development and monitoring.

(b) PURPOSES.—It is therefore the purpose of the Congress in this Act—

(1) to establish a comprehensive 5-year plan for Federal ocean pollution research and development and monitoring programs in order to provide planning for, coordination of, and dissemination of information with respect to such programs within the Federal Government;

(2) to develop the necessary base of information to support, and to provide for, the rational, efficient, and equitable utilization, conservation, and development of ocean and coastal resources; and

(3) to designate the National Oceanic and Atmospheric Administration as the lead Federal agency for preparing the plan referred to in paragraph (1) and to require the Administration to carry out a comprehensive program of ocean pollution research and development and monitoring under the plan.

33 USC 1702.

SEC. 3. DEFINITIONS.

As used in this Act, unless the context otherwise requires—

(1) The term "Administration" means the National Oceanic and Atmospheric Administration.

(2) The term "Administrator" means the Administrator of the Administration.

(3) The term "Director" means the Director of the Office of Science and Technology Policy in the Executive Office of the President.

(4) The term "marine environment" means the coastal zone (as defined in section 304(1) of the Coastal Zone Management Act of 1972 (16 U.S.C. 1453(1))); the seabed, subsoil, and waters of the territorial sea of the United States; the waters of any zone over which the United States asserts exclusive fishery management authority; the waters of the high seas; and the seabed and subsoil of and beyond the Outer Continental Shelf.

(5) The term "ocean and coastal resource" has the same meaning as is given such term in section 203(7) of the National Sea Grant Program Act (33 U.S.C. 1122(7)).

(6) The term "ocean pollution" means any short-term or long-term change in the marine environment.

SEC. 4. COMPREHENSIVE FEDERAL PLAN RELATING TO OCEAN POLLUTION.

33 USC 1703.

(a) LEAD AGENCY FOR PLAN.—The Administrator, in consultation with the Director and other appropriate Federal officials having authority over ocean pollution research and development and monitoring programs, shall prepare, in accordance with this section, a comprehensive 5-year plan (hereinafter in this Act referred to as the "Plan") for the overall Federal effort in ocean pollution research and development and monitoring. The Plan shall be prepared and submitted to Congress and the President on or before February 15, 1979, and a revision of the Plan shall be prepared and so submitted by February 15 of each odd-numbered year occurring after 1979.

Responsibility.

Submittal to President and Congress.

(b) CONTENT OF PLAN.—The Plan shall contain, but need not be limited to, the following elements:

(1) ASSESSMENT AND ORDERING OF NATIONAL NEEDS AND PROBLEMS.—The Plan shall—

National priorities.

(A) identify those national needs and problems, which relate to specific aspects of ocean pollution (including, but not limited to, the effects of ocean pollution on the economic, social, and environmental values of ocean and coastal resources), which exist and will arise during the Plan period;

(B) establish the priority, based upon the value and cost of information which can be obtained from specific ocean pollution research and development and monitoring programs and projects, in which such needs should be met, and such problems should be solved, during the Plan period; and

(C) contain, if pursuant to the preparation of any revision of the Plan required under subsection (a) it is determined that any national need or problem or priority set forth in the preceding version of the Plan should be changed, a detailed explanation of the reasons for the change.

(2) EXISTING FEDERAL CAPABILITY.—The Plan shall contain—

Existing Federal capability.

(A) a detailed listing of all existing Federal programs relating to ocean pollution research and development and monitoring (including, but not limited to, general research on marine ecosystems), which listing shall include, with respect to each such program—

(i) a catalogue of the Federal personnel, facilities, vessels and other equipment currently assigned to, or used for, the program, and

(ii) a detailed description of the existing goals and costs of the program, including, but not limited to, a categorical breakdown of the funds currently being expended, and planned to be expended, to conduct the program; and

(B) an analysis of the extent to which each such program, if continued on the basis and at the funding level described pursuant to subparagraph (A)(ii), will assist in meeting the priorities set forth pursuant to paragraph (1)(B) during the Plan period.

(3) POLICY RECOMMENDATIONS.—If it is determined, as a result of the analysis required to be made under paragraph (2)(B), that the priorities set forth pursuant to paragraph (1)(B) will not be adequately met during the Plan period using the existing Federal capability described pursuant to paragraph (2)(A), the Plan shall contain those recommendations for changes in the overall Federal effort in ocean pollution research and development and monitoring which would ensure that those priorities are adequately met during the Plan period. Such recommendations may include, but need not be limited to—

(A) changes in the goals to be achieved under various existing Federal ocean pollution research and development and monitoring programs;

(B) suggested increases and decreases in the funding for any such existing program consistent with the extent to which such program contributes to the meeting of such priorities;

(C) specific proposals for interagency cooperation in cases in which the pooling of the resources of two or more Federal departments, agencies, or instrumentalities under existing programs could further efforts to meet such priorities or would eliminate duplication of effort; and

(D) suggested legislation to establish new Federal programs considered to be necessary if such priorities are to be met.

Budget review.

(4) BUDGET REVIEW.—The Plan shall contain a description of actions taken by the Administrator and the Director to coordinate the budget review process for the purpose of ensuring interagency coordination and cooperation in (A) the carrying out of Federal ocean pollution research and development and monitoring programs; and (B) eliminating unnecessary duplication of effort among such programs.

"Plan Period."

(c) For purposes of this section, the term "Plan period" means—

(1) with respect to the Plan as required to be submitted on February 15, 1979, the period of 5 fiscal years beginning on October 1, 1978; and

(2) with respect to each revision of the Plan, the period of 5 fiscal years beginning on October 1 of the year before the year in which the revision is required to be prepared under subsection (a).

33 USC 1704.

SEC. 5. COMPREHENSIVE OCEAN POLLUTION PROGRAM IN THE ADMINISTRATION.

Establishment.

(a) ESTABLISHMENT OF PROGRAM.—The Administrator shall establish within the Administration a comprehensive, coordinated, and effective ocean pollution research and development and monitoring program. The Administrator shall carry out all projects and activities under the program in a manner consistent with the Plan.

(b) CONTENT OF THE PROGRAM.—The program required to be established under subsection (a) shall include, but not be limited to—

(1) all projects and activities relating to ocean pollution research and development and monitoring for which the Administrator has responsibility under provisions of law (including, but not limited to, title II of the Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1441-1444)) other than paragraph (2);

(2) such projects and activities addressed to the priorities set forth in the Plan pursuant to section 4(b)(1)(B) that can be appropriately conducted within the Administration; and

(3) the provision of financial assistance under section 6.

SEC. 6. FINANCIAL ASSISTANCE.

33 USC 1705.

(a) GRANTS AND CONTRACTS.—The Administrator may provide financial assistance in the form of grants or contracts for research and development and monitoring projects or activities which are needed to meet priorities set forth in the Plan pursuant to section 4(b)(1)(B), if such priorities are not being adequately addressed by any Federal department, agency, or instrumentality.

Grants and contracts.

(b) APPLICATIONS FOR ASSISTANCE.—Any person, including institutions of higher education and departments, agencies, and instrumentalities of the Federal Government or of any State or political subdivision thereof, may apply for financial assistance under this section for the conduct of projects and activities described in subsection (a), and, in addition, specific proposals may be invited. Each application for financial assistance shall be made in writing in such form and manner, and contain such information, as the Administrator may require. The Administrator may enter into contracts under this section without regard to section 3709 of the Revised Statutes of the United States (41 U.S.C. 5).

Contract authority.

(c) EXISTING PROGRAMS.—The projects and activities supported by grants or contracts made or entered into under this section shall, to the maximum extent practicable, be administered through existing Federal programs (including, but not limited to, the National Sea Grant Program) concerned with ocean pollution research and development and monitoring.

(d) ACTION BY ADMINISTRATOR.—The Administrator shall act upon each application for a grant or contract under this section within six months after the date on which all required information is received by the Administrator from the applicant. Each grant made or contract entered into under this section shall be subject to such terms and conditions as the Secretary deems necessary in order to protect the interests of the United States. The total amount paid pursuant to any such grant or contract may, in the discretion of the Administrator, be up to 100 percent of the total cost of the project or activity involved.

(e) RECORDS.—Each recipient of financial assistance under this section shall keep such records as the Administrator shall prescribe, including records which fully disclose the amount and disposition by such recipient of the proceeds of such assistance, the total cost of the project or activity in connection with which such assistance was given or used, the amount of that portion of the cost of the project or activity which was supplied by other sources, and such other records as will facilitate an effective audit. Such records shall be maintained for three years after the completion of such project or activity. The Administrator and the Comptroller General of the United States, or any of their duly authorized representatives, shall have access, for the purpose of audit and examination, to any books, documents, papers, and

Recordkeeping.

Accessibility.

records of receipts which, in the opinion of the Administrator or of the Comptroller General, may be related or pertinent to such financial assistance.

33 USC 1706.

SEC. 7. INTERAGENCY COOPERATION.

The head of each department, agency, or other instrumentality of the Federal Government which is engaged in or concerned with, or which has authority over, programs relating to ocean pollution research and development and monitoring—

(1) shall cooperate with the Administrator in carrying out the purposes of this Act;

(2) may, upon written request from the Administrator or Director, make available to the Administrator or Director, on a reimbursable basis or otherwise, such personnel (with their consent and without prejudice to their position and rating), services, or facilities as may be necessary to assist the Administrator or the Director to achieve the purposes of this Act; and

(3) shall, upon a written request from the Administrator or Director, furnish such data or other information as the Administrator or Director deems necessary to fulfill the purposes of this Act.

33 USC 1707.

SEC. 8. DISSEMINATION OF INFORMATION.

The Administrator shall ensure that the results, findings, and information regarding ocean pollution research and development and monitoring programs conducted or sponsored by the Federal Government be disseminated in a timely manner, and in useful forms, to relevant departments, agencies, and instrumentalities of the Federal Government, and to other persons having an interest in ocean pollution research and development and monitoring.

33 USC 1708.

SEC. 9. EFFECT ON OTHER LAWS.

Nothing in this Act shall be construed to amend, restrict, or otherwise alter the authority of any Federal department, agency, or instrumentality, under any law, to undertake research and development and monitoring relating to ocean pollution.

33 USC 1709.

SEC. 10. AUTHORIZATION OF APPROPRIATIONS.

There are authorized to be appropriated to the Administration for the purposes of carrying out this Act not to exceed $5,000,000 for the fiscal year ending September 30, 1979.

Approved May 8, 1978.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 95-626 pt. 1 (Comm. on Science and Technology) and 95-626 pt. 2 (Comm. on Merchant Marine and Fisheries).

CONGRESSIONAL RECORD:

Vol. 123 (1977): Aug. 3, considered and passed Senate.

Vol. 124 (1978): Feb. 28, considered and passed House, amended.

Apr. 24, Senate agreed to House amendment.

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